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The Zipernowsky Electric Railway.

Our illustrations show side and end elevation and section of the new form of electric railway which is now building at Buda-Pesth, the invention of Mr. Charles Zipernowsky, the chief electrician of the well-known electrical firm of Ganz & Company, of Buda-Pesth, Austria-Hungary. Mr. Zipernowsky's idea in this railway is to avoid cutting up the street with parallel lines of track. By Mr. Zipernowsky's system, there is only one rail, and that is a split rail laid in the center or at the side of the street, and supported from below the level of the street. The principle of the tramway is that all the wheels upon which the vehicle rests run upon one or two lines, whose distance apart is so small that the stability of the car is not secured by them, as will be readily seen by reference to the drawings. The stability of the vehicle is secured by the construction existing below the street level, which bears upon the line of rails there located. These guiding rails, are placed within a conduit. The car, it will be seen, is supported upon pairs of oblique and converging wheels, so arranged as to transfer the horizontal pressure resulting from unsymmetrical load, and the swaying motions of the car to the double rail. From the body of the car projects, downward, two or more arms, which are carried through the rail-slot, and carry at their lower ends guiding wheels, which bear against the sides of the rails. Mr. Zipernowsky claims that this method of obtaining stability of the car is much better than where the cars run on parallel rails, for the reason that it is easy to keep the track clean, and such rails are not liable to be affected by ice and snow. While we do not show it in the drawings, it is Mr. Zipernowsky's intention to run this road by one of two methods; first, electrically, using the rails as conductors; and, second, by the use of a cable, the central support being used as a grip. It is obvious that the two plans may be combined, and the road now building at Buda-Pesth—as also one at Vienna—will be arranged for both cable and electricity, the idea of the projectors being that the cable may be easily introduced, the machinery necessary to operate the cable is comparatively small, and inexpensive, when it is taken into consideration that the same boiler and engine power is required for the electric machinery.

Our readers will understand that the government regulations on the continent of Europe are much more severe than anything our companies are subjected to here. When a road is built, it must be built to go, and the authorities would not allow, for a moment, an experimental plant to be constructed to the destruction of the streets and the danger of the public at large.

Mr. Zipernowsky's plan is certainly very novel, and if it proves to be successful, will be a great boon to cities, as the surface of the streets will be materially improved with a single instead of a double rail.

The Navy Department has followed the example of the army signal office in discarding the European Morse telegraph code and adopting the American Morse in its stead.

Quick Electric Lighting.

A singular illustration of the adaptability of the electric light in an emergency was recently afforded. In consequence of a serious strike among the gas employés in Manchester, and the total failure of the gas supply, the Lancashire & Yorkshire Railway Company decided to light their Victoria station, which is the largest in Manchester, with the electric light, and within six hours of the time the order was given the most important platforms were lighted, and the whole station was brilliantly illuminated with about 250 incandescent and a few arc lights within 36 hours, and yet the current had to be conveyed for a quarter of a mile, and all the necessary circuits had to be run. The company is so well pleased that steps are being taken to have the electric light fixed permanently.

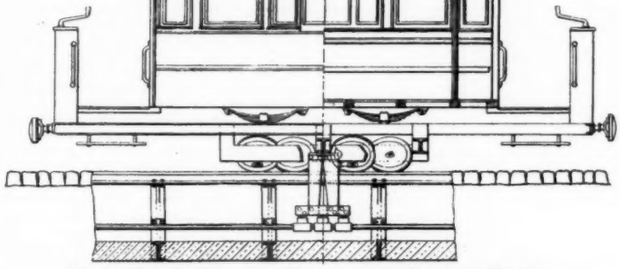

FIG 1.—THE ZIPERNOWSKY TRAMWAY AND VERTICAL TRACK.

Need an Electric Railway.

The Duluth Street Railway Company claims to have the finest street car system ever invented. It goes to a great expense to maintain it, too. Several passengers got on at Twentieth avenue and were then driven by swift-footed mules to Thirteenth avenue, where the track is torn up. There they waited for the short space of 15 minutes for another car also drawn by swift-footed mules. Then they changed cars and were driven to the barn, where several men talked earnestly for another 15 minutes as to whether or not the car should go into the barn. It was finally decided that it should, and with the passengers inside the car it was driven in the barn. The passengers were then told that another car came along in only 40 minutes. They decided to walk.

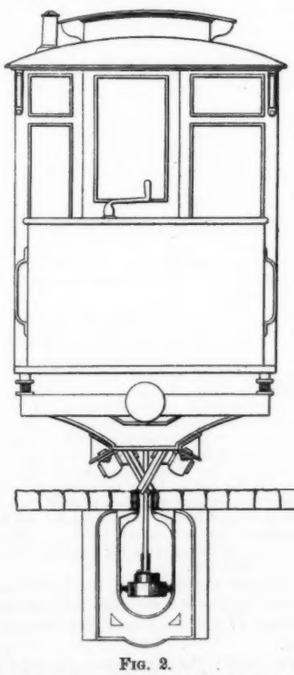

FIG. 2.

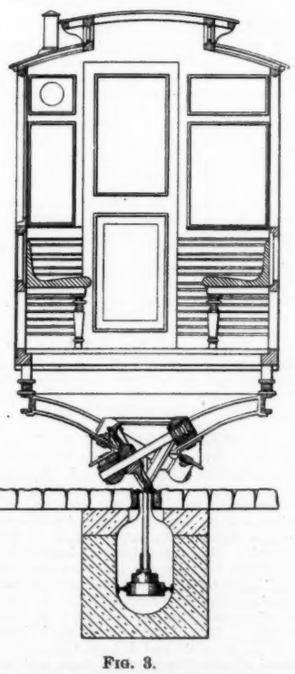

FIG. 3.

The Press and Electrocution.

A proposition is before the Assembly to amend the electrical execution law by striking out the absurd provision that representatives of the press shall be excluded from witnessing such executions and prohibiting the publication of reports of them. It should be passed for obvious reasons. In the first place, the provision is of doubtful constitutionality in its abridgment of the right of free speech, and certainly transcends public sentiment with reference to the freedom of the press. In the next place, it is perfectly senseless to suppose that any law can keep reporters from securing information or newspapers from publishing the news which their readers demand.

AT KANSAS CITY.

TRIP OF THE "ELECTRIC LIMITED." —WELCOMED BY MAYOR DAVENPORT.

FULL ACCOUNT OF THE PROCEEDINGS OF THE ELEVENTH CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION. —NEXT PLACE OF MEETING, CAPE MAY, NEW JERSEY.

The "Electric Limited" train for the Kansas City Electric Light Convention contained 72 passengers after the Philadelphia contingent came aboard, seven of whom were central station men. The trip, the entire route from New York to Kansas City, was a pleasant one; the Pennsylvania and the Burlington Route Railway Companies vieing with each other in looking after the comfort of the passengers. In this respect they were eminently successful, and Messrs. Haines, of the former, and Heller, of the latter, received many compliments in regard to the splendidly equipped train and its excellent management throughout.

At Chicago, the Electric Club, through its committees, met the delegation and provided carriages to the club house, where a lunch that did credit to Caterer Kinsley was served, and abundantly partaken of. Mayor Cregier, of Chicago, welcomed the party in a pleasant speech, which was replied to on the part of the Easterners by Mr. A. H. Patterson. At five P. M. the start was promptly made from Chicago, three more cars being added to the train, making eight in all, and this large train, composed entirely of Pullman palace cars, steamed into Kansas City behind two puffing locomotives at nine A. M., Tuesday.

The headquarters of the Association were at the Coates House, the Convention meeting in the Coates Opera House, across the street, the electrical exhibition being held in the Casino, a few doors above.

THE FIRST DAY—FEBRUARY 11.

There were 163 persons in the opera house when President Weeks called the Convention to order at 12.30 P. M. The house is lighted throughout by electricity, the symbol

$$C = \frac{E}{R}$$

appearing over the front stage, made up of colored electric lamps. This lettering also appeared on the very beautiful solid silver badges presented to each attendant, and these were presented to the Eastern delegation by a committee which met the train an hour out of Kansas City.

The president introduced Major J. J. Davenport, of Kansas City, who welcomed the convention in the following address:

THE WELCOMING ADDRESS OF MAYOR DAVENPORT.

Mr. President, Ladies and Gentlemen of the Convention.—To me has been assigned the pleasant and agreeable duty of welcoming you to our city, where many of the most important and interesting conventions that have been held throughout the United States during the years of 1889 and 1890 have sat in deliberation. To none, however, have I extended, in behalf of our citizens, a more

cordial and heartfelt greeting than it is now my pleasure and privilege to offer you, whose coming has been a source of pleasant anticipation, mingled, perhaps, with the hope that here, in the center of this great American Union, the verge or margin of that borderland of science, which Mr. Thurston so graphically depicts, may some day find its beginning. A land where it is said the portrait of the sender of each telegraphic dispatch will accompany the message; when submarine and aerial navigation will be carried on successfully by the power derived from stored electricity; when the soft light of the fire-fly or glow-worm will be produced by man, and the direct conversion of heat into electricity will be solved. The result of your deliberations will be anxiously awaited by the whole commercial world, as well as the scientific, because electricity has given an impetus to the former that has driven and impelled it forward with wonderful rapidity and signal success to its present high state of perfection. Its civilizing influences have extended the confines of education, refinement and culture, to the uttermost parts of the earth. You, gentlemen, are the exponents of laws which govern one of the most powerful forces of nature, under the action of which energy becomes appreciable. You teach us that, like heat, light or work, it is measurable and can be produced, or converted into other forms of energy. By means of this marvelous agency you have already presented to science most wonderful aids, by which she has been able to make visible what has hitherto been invisible, to make audible what has been inaudible, and to discover what has not been dreamed of in the philosophy of mankind, for, whether its manifestations be considered under the head of static, galvanic or Faradic, it is all electricity—it is all witchcraft with its future possibilities entirely inconceivable except to such research as may result from distinguished and able gentlemen, such as compose this assembly. As we hear of these mysterious currents measured by amperes, and of the power by which various bodies resist these currents measured by ohms, we seem to be attaining the condition of life of which Mr. Thurston speaks, or that so cleverly portrayed by Bulwer in his "Coming Race," in which all are happy and harmonious, seeming to have reached the millennium, Evil being held in bondage by the potent "Vril" wand, which gives to all alike motive, defensive and creative power, with also the perfect knowledge of how to use it for the greatest and best good of all. Electricity is our magic "Vril" wand, and you are teaching us its capabilities. Six years ago it had not been used upon the broad ocean, that difficult and dangerous field of warfare. When the Navy Department fitted out the frigate "Trenton" with an electric incandescent plant, the eyes of the world were upon her, eager to see the mooted question settled as to how the glass bulbs and carbon filaments would bear the firing of the frigate's guns. The three years' successful cruise proved so much to the United States and to those foreign countries who are learning to follow in her footsteps that now a man-of-war is not equipped without the incandescent lighting plant, and the "arc" for the "search," which reveals not only the dangers of the surface of the mighty ocean, but pierces her briny depths, detecting death-dealing torpedoes that have been laid for destruction. This faithful servant of man now not only guards the vessel from the inventions of the enemy, but aims and fires the guns, illuminates the sights, that the aim may be sure, discharges torpedoes, measures her speed, is the most successful motor for submarine boats, and renders possible a system of visible telegraphy by which communications may be flashed against the clouds and understood at a distance of 60 miles. We welcome you as true benefactors of mankind, the emancipators of the human race from darkness. What you and those of your profession have accomplished within the past years reflects credit upon your country, borders close upon the miraculous, and entitles you to imperishable honor and renown. I will not detain you in enumerating your achievements, gained by the most faithful and unremitting labor. Cost, or dollars and cents, is the great obstacle in the way of the speedy and universal adoption of many of your most important discoveries and perfected inventions. Electricity, to-day, is at its highest cost, and we look forward to the time when, being cheaper, it will accomplish for humanity all that it now promises. It is estimated that at the beginning of the year 1890, $600,000,000 was invested in the electrical industry in the United States, and that 250,000 persons depended upon it for their means of living. That 1,000,000 miles of telegraph wire are in operation, enough, it is said, to encircle the globe 40 times. Three hundred thousand telephones are constantly talking, and an average of 1,055,000 messages are sent daily, requiring the use of 170,000 miles of wire. The longest distance over which conversation is maintained is 750 miles, *i.e.*, from Portland, Me., to Buffalo, N. Y. Just how many of the musical kind are in use, that Mr. Bellamy speaks of, I do not know. Four hundred miles of electric railway are in active operation in America. The fastest speed attained in the transportation of passengers has been 20 miles on hour. I believe Mr. Weems has quite recently, at Laurel, Md., upon an experimental track, made two miles a minute, or 120 per hour. There were no passengers upon that train, however, it being used exclusively for baggage, which is hereafter to be sent in advance. At your annual meeting at Niagara Falls, the statement was made that there are in use, in the United States, 237,017 arc lamps, and 2,704,768 incandescent. I hope that the increase will be so great within the next few years that the various companies will find it impossible to furnish light and motive power at much lower rates. Electric light is certainly the only form of artificial illumination not injurious to health, and, therefore, it is our hope that all classes may soon, in consequence of its cheapness, be enabled to enjoy its benefits. The mystery which seemingly surrounds electric service, will, in time, be dissipated, and it will come to be regarded with less suspicion and fear. Perfection cannot be expected in the use and distribution of such force and power immediately. Danger to human life and property interests are questions in which we are all concerned, but it will not do to condemn without comparison and investigation, else we may deprive ourselves of valuable agencies and servants, whom to understand is to bring us health, wealth and prosperity. Immense poles, that make unsightly our most beautiful thoroughfares, over which hang a dense mass of wires to obstruct access to our buildings in case of fire, and almost shut out the light of day, will in time disappear. It was necessary that they should precede the subways now coming into use, but not yet, I believe, admitted to be universally successful, though the Bell Telephone Company had, in 1887, 6,030 miles of wire underground; in 1888, 8,009; and in 1889, have increased it to 17,038 miles. Taking into consideration, however, the service performed and work done through the means of this unseen power, it is pleasing to note that the casualties resulting from its use are less than from any other service. (Applause.)

To the future we can only look with wondering eyes and bated breath, and to you as the workers of miracles. May your deliberations, gentlemen, while here, be as harmonious as the laws which govern the marvelous and wonderful philosophy of electricity.

President Weeks then addressed the Convention as follows:

Gentlemen: At our first Convention, held in February, 1885, there were 87 delegates, full of enthusiasm for the good to be accomplished. I believe, gentlemen, that they have not been disappointed in the work of this Association. As one of the original 87, I point with pride to five years of broadening and harmonizing influence; and I believe that every central station, every factory, every supply company in the country, has felt its impulse toward improvement.

To-day, gentlemen, we number 304, representing not only a wider extent of territory than ever before, but all the leading systems of the United States. A more fraternal spirit now prevails between the electric light and power men, and our elder brothers of the telegraph and telephone interests, a pleasant proof of which has been given by the hearty co-operation of their representatives in this city, in preparing for the entertainment of the Convention. (Applause.)

The past work of the Association speaks for itself, but our number has so increased, and our sphere of usefulness has so advanced, that we must look for work of a better character than was possible in earlier days, when most of our members were new to the duties which they had undertaken. We now need work of more direct practical value to central station men, and theoretical work of a higher grade than that of the past, good as that has been. With this in view, we have endeavored to prepare a programme of such importance, both practically and theoretically, that you will find it good to be here.

The committee on State and Municipal Legislation will report the organization of State associations with a view to developing among legislators a full appreciation of the importance and needs of the electrical industries, and to present these industries in their true light. The urgent need is for organization along the lines of legislation and popular education. This can be best accomplished by State associations, whose conventions could advantageously take the place of the semi-annual meetings of this Association. Ten of these State associations have been formed, and I hope that before the close of this Convention, steps will be taken toward the organization of many more.

The increasing interest in railroad work and the immense field for future development in the motor department, will render especially pertinent the discussion by Mr. Sprague, and also the work of the committee on standardization of potential on electric street railways, the report of which will be submitted through its chairman, Mr. Lynch.

As the growth of our industry must be chiefly in the direction of incandescent light and power, the discussion to be presented by Mr. Field is of the greatest importance, both to central station men, and to all who desire electric service in their homes.

The watch-words of the future are certainly economy of fuel and perfect insulation, and, while there may be improvements in designs for apparatus and in methods and means of distribution, and while we still hope for the direct conversion of the energy of coal, the advance of the immediate future should be in the direction of economizing present waste, rather than in the discovery of new facts or principles. (Applause.) Americans are proverbially prodigal, and there is an absolute and growing need that waste and loss should be arrested. While the demand for the necessary elements is increasing with the population, the supply of many of those elements is steadily diminishing. Messrs. Babcock and Sickles will doubtless point out lines of economy in the department of steam engineering, and Mr. Smith will present for our consideration another phase of the same question—"A Universal System of Central Station Accounts." The many problems arising in the electrical and mechanical departments of the operation of central stations, have left this question to general neglect. But now that we are becoming passably familiar with the tricks of our apparatus, attention is more and more directed to data for comparison, with a view to economic methods.

The topic of the hour is certainly safety. It would seem that, in view of the relatively small number of serious accidents connected with electrical industries, we have grounds for some impatience with the present outcry against electricity as a dangerous servant. It is true, that, compared with those which have accompanied the introduction and use of steam and gas, the number of accidents in the use of electrical apparatus is very small. But in this age, comparative rates will not be accepted as answers; the people have a right to demand that devices for public safety keep pace with development in other directions. The papers of Professor Thomson and Messrs. Haskins and Harber, will present this current topic in its various phases. I trust that each speaker will enforce the importance of good construction and maintenance on the part of producers, and proper inspection on the part of the municipality.

It is hoped that the committee on underground conduits and conductors will be able to report some facts regarding the actual operation of high pressure currents underground. Thus far, discussion on this topic abounds in theory and speculation, but contains little experience.

During the past 12 months there has not only been a greatly increasing activity in the electrical industries abroad, but many millions of foreign money have been invested in the electrical properties of America. It is worthy of note that our brethren in Great Britain have set the example of adjusting differences amicably, instead of carrying litigation to the court of last resort. Such a policy in America would not only have saved hundreds of thousands of dollars now charged to profit and loss, but would have greatly enhanced the value of electrical securities.

The past year has furnished instances in which the value of local electrical properties has been greatly depreciated through the invasion of territory already fully occupied. This policy is shortsighted. Prices in most cities are fair and just both to consumer and producer. To depreciate them will not only ruin the business of pioneer companies who have invested large sums, and borne the brunt of introducing a new and valuable industry, but cannot fail to result in great loss to the invader.

Although electric lighting in this country has seemed to receive a check, a look ahead would not be discouraging. The law that "action and re-action are equal and in opposite directions," applies not only to mechanics, but to public opinion. As America is the birthplace of the commercially successful electric light, and as Americans are the foremost people of the world to recognize improvements, we may well believe that with proper attention on our part to our duties to the public, the present popular and largely sensational agitation against us will give place to a feeling of confidence. In the meantime, let the outcry teach its proper lesson to all engaged in the electrical business. (Applause.)

Secretary Garratt called the roll of the association, and the responses indicated the presence of somewhat more than 100 members.

The Chair: The next business in order is the reading of the report of the secretary and treasurer. Before that is done, however, it may be well to say that it is designed to hold a very brief session to-day, and adjourn in plenty of time for lunch. (Applause and laughter.)

Secretary Garratt presented his report as follows:

Report of the Treasurer and Secretary of The National Electric Light Association, December 31, 1889—Presented at the Kansas City Convention, Feb. 11—14, 1890.

Balance from account rendered July 31st, 1889, at Niagara Falls	$1,096.93	
Dues from 51 members	1,020.00	
	$2,116.93	
Expenditures as per accompanying Vouchers, Numbers 87 to 112, inclusive		$1,506.76
Balance, Cash on hand, Dec. 31st, 1889		610.17
		$2,116.93
The indebtedness of the Association is an unpaid bill of		259.60
The above Expenditure of $1,506.76 for the six months ending Dec. 31, 1889, may be classified as follows:		
Postage		$48.52
Stationery and Printing		143.90
Official Stenographer		85.37
Rent of Office		50.00
Advertising		46.99
National Committee on State and Municipal Legislation		98.65
Salary of Treasurer and Secretary		999.96
Expenses not specified above		33.37
		$1,506.76
The total receipts for the year 1889 have been, inclosing the Balance from the previous account	$5,845.55	
Total expenses for year 1889		$5,235.38
Balance, Cash on hand Dec. 31, 1889		610.17
		$5,845.55
The Expenditures of the year 1889 may be classified as follows:		
Old Bills incurred previous to 1889		$1,483.82
Salary of Secretary and Treasurer 12 months		1,999.92
Clerk Hire		40.00
Postage		176.48
Printing and Stationery		712.19
Official Stenographic Reports		246.62
Rent of Office		307.50
Advertising in Electrical Journals		101.99
National Committee on State and Municipal Legislation		98.65
Not otherwise specified above		168.21
		$5,235.38
The net income for 1889 was	$5,545.82	
The running expenses for 1889 were		3,751.56
Excess of net income over running expenses		1,794.26
		$5,545.82

Membership.

Total number of Members July 31st, 1889	251
Members added between July 31 and Dec. 31, '89	21
Total	272
Members resigned between Jan. 31 and Dec. 31, '89	13
Making total Membership, Dec. 31, 1889	259

It will be noticed that the above reports close Dec. 31, 1889, which is the end of the fiscal year. Since then I have received funds in the shape of dues, and have added a number of new members to the roll of the Association.

On motion the secretary's report was accepted.

Secretary Garratt read communications from the following: A communication from the Commercial Club, of Kansas City, tendering the Convention a reception Tuesday evening, February 11th. The courtesy of the Commercial Club was accepted with a vote of thanks.

The secretary also read a communication from W. H. Briethaupt, president of the Engineers' Club, of Kansas City, tendering the privileges of the club room of that club to the National Electric Light Association during the Convention.

Also a communication from J. H. Veitch, general agent of the Chicago, Milwaukee and St. Paul Railway, extending an invitation to the members of the Association to visit the health resort of Missouri—Excelsior Springs—and offering a train for that purpose on Wednesday, the 12th, at any hour which might suit the convenience of the Association. A communication from Edward Holden, president of the Excelsior Springs Company, extending an invitation to the same effect, was also read.

The secretary also read a communication from William Wiley Smith, secretary and superintendent of the Missouri and Kansas Telephone Company, of Kansas City, extending congratulations to the Association and offering telephonic facilities between the halls and the central office, and also extending to the delegates an invitation to visit the central office of the telephone company, in which, as was stated, nearly 2,600 wires were handled in one room, and over 32,000 calls per day were made.

A. J. DeCamp: I move you that the invitations just read be accepted, and the president be authorized to arrange a time satisfactory to all parties.

Mr. Degenhardt: I move an amendment, Mr. President, and that a vote of thanks to this Association be tendered for the courteous invitations that have been received. Carried unanimously.

Secretary Garratt: Mr. President, there are two more letters that have been received, one from the National Home for Disabled Volunteer Soldiers, at Leavenworth, Kan., which is as follows:

I have the honor herewith to extend an invitation for the Association, of which you have the distinction of being the head, to visit the National Military Home for D. V. S. I am sure I can make your stay pleasant. Kindly notify me which day of your session will be most convenient for you. My time is at your disposal.

If you accept, please time your departure so that you may arrive by 11.30 A. M.

Very respectfully,
ANDREW J. SMITH, *Governor.*

Mr. DeCamp: I move the invitation be received, with thanks. Carried.

Secretary Garratt: There has also been received an invitation from Mr. George W. Warder, as follows:

February 11, 1890.

HON. E. R. WEEKS, President:

Dear Sir: It gives me pleasure to tender to your Association a reception to be held at the Warder Grand Opera House on Friday evening, February 14th, if agreeable to your Association.

Should this invitation be accepted, I would be pleased to have your response (or meet any committee you may see fit to appoint) as soon as possible.

Very respectfully yours,
GEORGE W. WARDER.

Mr. Kempt: Mr. Chairman, I move that these two last invitations be referred to the executive committee, to take such action upon them as in their wisdom may seem proper. Carried.

Secretary Garratt then announced a meeting of members from Missouri for the purpose of forming a State association, and gave other notices.

President Weeks: Gentlemen of the Convention, owing to the occupancy of this house to-morrow for a matinee, our session to-morrow will be held in the Music Hall just across the street and a little way down. I hope that when we adjourn this afternoon, we will adjourn to an early hour at that hall, as we have a long and interesting programme to get through with at that time.

I would say that the reception committee would be glad to see as many as would like to go with them this afternoon, to make the rounds of the city by means of cable cars and elevated roads, and to have all such signify to them their disposition to do so, shortly after lunch. It would be well for you to get together as soon as possible after three o'clock.

Before adjourning, I would also remind the Association of the reception at the Commercial Club this evening, at eight o'clock. This reception will be informal and you are all cordially invited.

Mr. Faben: Mr. President, I suggest that we meet early to-morrow, and for that purpose I move you that we meet here promptly at nine in the morning, and at 1.30 at Music Hall.

Mr. Degenhardt: I desire to call your attention to the death of Mr. C. McIntire, which seems to have been overlooked. I feel that the Association should take some action in regard to the matter, and know they will be glad to pass a suitable resolution. I move you, sir, that the chair appoint a committee of three to draft suitable resolutions concerning the death of our member, Mr. McIntire.

Secretary Garratt: May I also make a suggestion? Miles W. Goodyear, of New York, a member of this Association, has also died during the past year, and I would suggest as an amendment that the resolutions be made to embrace his name.

I had no knowledge of the death of Mr. McIntire, or, of course, his name would not have appeared upon the roll as an active member. The motion prevailed.

President Weeks: I will appoint as members of the committee to draft appropriate resolutions, Mr. Degenhardt, Mr. Candee and Secretary Garratt.

On motion the Convention adjourned to meet at the Music Hall at nine o'clock, A. M., February 12, 1890.

REPORT OF COMMITTEE ON STANDARDIZING OF POTENTIALS.

Gentlemen of the National Electric Light Association:

In behalf of the committee appointed at your last meeting, for the standardizing of potentials for electrical apparatus for street railway systems, I would present to the Association the following report:

It was deemed advisable by the members of the committee to send out a circular to all railway companies operating their systems of car lines by electricity, notifying them of the appointment of this committee, and asking not only their co-operation, but also drawing their attention to a number of questions that we desired they should reply to. Acting upon this conclusion, the committee drew up and mailed to all these companies the following circular:

Gentlemen: At the semi-annual meeting of the National Electric Light Association, held at Niagara Falls, on August 6, the following resolution was offered and adopted:

"*Whereas*, it is the belief of the members of this Association that the electric motor service upon street railways will require a service of electric current for the motor, that will be reliable and constant, and that the various electric light stations are capable of generating and distributing such current,

"*Resolved*, That a committee of three be appointed by the president, who shall endeavor to make such arrangements with the manufacturing companies, that they should adopt some standard potential to be used upon the various railways. The committee also to collect such data regarding the supply of current to railways as may be deemed of interest to the Association."

The president appointed Messrs. Eugene T. Lynch, Jr., of New York; T. Carpenter Smith, of Philadelphia, and Marsden J. Perry, of Providence, as members of that committee.

It has been thought advisable to collect and compile the opinions and the experiences of such street railways that have adopted electricity as a motor power. Will you, therefore, kindly fill out and answer such of the following questions as you feel you can answer?

1. What system do you use?

2. What proportion of your cars are equipped with motors?

3. Do you generate your own electrical power, or are you supplied by an electric light station?

4. What proportion does your greatest average horse-power in use bear to the total horse-power of engines and boilers which you have installed?

5. What is the voltage or pressure of your generators?

6. Is there any other railroad in your town using an electric system? If so, what system do they use, and do you know the pressure at which they run?

We have received replies from 85 per cent. of all the electric street railway companies. They have one and all showed every disposition to give us full reports upon the questions that we have asked them, and have stated that they would afford us every facility that lay in their power, and that they desire us to convey to the National Electric Light Association their hearty endorsement of this plan.

We think it advisable to divide our report into three parts. First: A statement of the conditions under which the various railways have been operating up to the present time. Second: The report of your committee upon the arrangements made with the manufacturing companies. Third: A set of statistics carefully compiled from reports made by some of the most prominent central stations, showing the advantages that will accrue to the investor by the combined operation of the electric light and electric street railway interests, working under the agreements that have been promised to your committee.

First.—Under the first question we do not desire to give any statements regarding the number of railways that may be operated by any particular company, beyond the fact that fully 90 per cent. of all the railways, now in successful operation, are operated under the systems controlled by the Thomson-Houston and Sprague Companies.

In answer to our second question, we find that at least three-fourths of the railways have equipped all their cars with motors, and that the sizes of the motors upon the cars vary fron 7½ to 15 horse-power.

Only nine electric light companies have been brave enough to agree to supply the street railway companies with their power, although in nearly every case, when the railway was in operation, there was at least one central station company who could have contracted to supply the necessary current.

The answers to the fourth question give to your committee the information that will prove of value to the Association

In all railways operating over 15 cars, only one-third of the total horse-power with which the plant has been equipped, has ever been called for at one time. On all roads operating between five and 15 cars, the greatest average load has not reached 50 per cent. of the total horse-power, and upon smaller roads, the average load has varied from 50 to 80 per cent. of the total horse-power. All roads that have met with heavy grades, have missed the average very considerably.

We find that the potential varies from 220 to 800 volts, the greater number of companies, however, report using a potential between 450 and 550 volts.

Our sixth question was directed partly as a check upon our being furnished correct information upon the names and localities of the various roads, but mainly to ascertain whether an opportunity was afforded to operate several street railway companies from the same central station plant.

The answers to this have been many and curious. In some cases they have disowned all knowledge of the existence of any other company, and in nearly every case, they seem to be imbued with the rivalry, quarrels or misunderstandings, of the various patent or manufacturing companies whose apparatus they are using. They agree, however, that they would be willing to use the power supplied to them from some central station, provided that they be assured by the company who equipped their road, that the potential of quantity of current used, would not be detrimental to their apparatus.

Copies of the circulars, together with a letter explaining more fully the plan suggested by your committee, were sent to all the manufacturing companies. They were also requested to furnish the committee with a list of the particular railways operating under their system. After much correspondence and many personal interviews, your committee would announce that they have written authority from both the Thomson-Houston and Sprague Street Railway Companies, to make the statement on behalf of their particular companies, that they will agree hereafter to use a standard potential of 500 volts upon all electric street railway equipments that do not require any special apparatus for their successful operation.

In recommending electric light companies to add to their regular central station business the business of furnishing power to street railroads, we wish it fully understood that we do not base any hopes of profits to be made upon the old-time idea that the same machinery can be used for furnishing light at night and power in the day-time. This specious argument has led many companies into large expenditures for motors, etc., and they have discovered later that it costs very nearly twice as much money to run the same machinery night and day as to run it at night alone, and that it pays better in the long run to have an entirely different class of apparatus to produce light and power.

The true direction from which returns may be expected in the massing in large stations of the generation of electricity for both light and power, is found in the fact that an electric light station, to be sure of continuous running, requires a reserve of from 15 to 25 per cent. of its average load in boilers, engines and dynamos; the per cent. being larger in small stations and diminishing as the station increases in size.

This same reserve in capacity is required for the power station, but on street car work in most of the stations hitherto installed this percentage runs very much higher, being from 50 to 80 per cent. It will be manifest to every one, on a little reflection, that a station which is generating current for two street cars is compelled to have power enough provided to allow of the throwing on at the same instant of both these cars, that is to say, generating capacity of fully twice the average amount of power, or 100 per cent. reserve; as more cars are added, the chance of any particular number being thrown on at one time becomes less and less, until in a station operating 200 cars, a single spare generator to take the place of any one which might be disabled would probably be all the reserve needed. This feature is shown very clearly in the running of the ordinary three-wire electric station, where, when the total

(Continued on page 7.)

Illinois.—The Hyde Park Electric Light and Power Company, at Chicago, filed a certificate of decrease of capital stock from $500,000 to $100,000.

Kingston, N. Y.—The Wilson Electric Company, to furnish light, heat and power, in the city of Kingston, have filed papers of incorporation. Their capital is placed at $150,000.

Illinois.—The Sunbeam Incandescent Light Company, at Chicago, to manufacture and sell incandescent lamps; capital stock, $25,000; incorporators, Jean Elliot, F. W. Parker and D. Johnson.

Portland, Me.—The Russell Electric Lamp Company, principal office, Portland; capital stock, $300,000; paid in, $300,000; par value shares, $1. President, A. W. Rounds, Boston; treasurer, F. H. Carpenter, Boston.

Missouri.—The East St. Louis Electric Street Railway Company was organized last week, and will apply for incorporation. The company will have a capital of $500,000, and will apply for a franchise to operate an electric railway through the principal streets of the city.

Virginia.—The House of Representatives has passed the bill to incorporate the Richmond Railway and Electric Company. Under this charter the Richmond Union, the Richmond City, and the Richmond, Manchester and Electric Light Companies, are authorized to unite into one organization or company.

Albany, N. Y.—The Commercial Union Telegraph Company has filed a certificate of increase of capital stock, from $300,000 to $500,000. It is the intention of the company to connect Albany with Kingston, Rondout, Newburgh and New York, with branch lines to Poughkeepsie and Pawling. It is reported that the company will extend its lines to other towns in this State.

Indianapolis, Ind.—The Edwards Railroad Electric Light Company has been incorporated by Edgar A. Edwards, Charles G. Jenner, Charles L. Doughty, W. N. Gray and Walter Cox. Its object is to manufacture and repair all kinds of electric machinery and locomotive head-lights. The capital stock is $1,500,000. The business of the company is to be throughout the United States, but its headquarters and home office are in Indianapolis.

New Jersey.—The Electrical Novelty Company, of Montclair, N. J., has filed articles of incorporation in the county clerk's office. The object is the manufacture of telegraphic instruments, particularly for the use of persons learning telegraphy, and to carry on a general electrical manufacturing business. The capital is placed at $45,000. The incorporators are Walter A. Phillips, Charles H. Bogle, Fred M. Bassett, of New York; Thomas R. Talbarall, of Montclair; R. S. Howland, Providence, R. I.: A. H. Sewell, Norton, Mass.; Nettie B. Ryder, Taunton, Mass.

New York.—The New York and Long Island Telegraph Company has been incorporated at Albany with Charles Shirley, John W. Roloson, Simon E. Ostrom and Thomas F. Jennings, as incorporators. The general route is from New York city to Brooklyn, to Coney Island, to Hempstead, to Jamaica, to Rockaway, to Far Rockaway, and to such other points on Long Island as may hereafter be determined upon. The capital is $5,000, divided into 10 shares. The association is permitted by its certificate to increase its capital to $10,000. Each of the incorporators takes 75 shares. Messrs. Roloson and Ostrom reside in Brooklyn.

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The regular monthly meeting of the Electric Club will be held at the Club House, 17 East 22d street, city, Thursday evening, February 20th. Mr. Grosvenor P. Lowrey will deliver the address. Subject: "Patent Law and What Constitutes an Invention." We call attention to this again as we publish this edition on the 18th inst.

If reporters for the daily papers, who do not claim to be expert electricians, would avail themselves of practical talks with electricians with whom they come in contact, and read an elementary treatise on the fundamental laws of electricity once in a while, the sensationalism now so prevalent in the daily press would be abated. We would not then hear so much about "ohms and amperes whizzing about people's heads," as a reporter had it recently in describing a fire in an electric light station.

Our eighth anniversary occurred on Feb. 15. Just eight years ago the ELECTRICAL REVIEW made its appearance and claimed recognition as an independent representative in the field of electrical literature. The REVIEW was then a 16 page journal without a cover. Our edition of to-day is 40 pages. Such progress speaks for itself, for the great field it covers, and the enterprise behind it. We feel just a little pardonable pride in the improvement shown in these pages during the period passed, and we can assure our readers that the same policy which has made the REVIEW what it is to-day, will be pursued in the future.

During the year 1889, no less than 108 persons lost their lives through gas in the United States. This is a greater number of deaths than have been caused by electricity during the last ten years.

The attempt to secure the enactment of a law prohibiting the use of any high-tension lighting currents in the State of Virginia, has, very properly, proved a failure. After investigating the subject, the committee to which it was referred reported against the measure.

The people of the United States have been treated to learned discussions in the daily journals relative to the comparative danger in the use of alternating and continuous currents of electricity for electric lighting. Almost every reporter of the daily press has explained at great length what he did not know about it, or in well written interviews has made more than one well educated electrical engineer talk like the veriest charlatan. Extraordinary and wonderful are the statements which have appeared, and the good public, which reads the papers and takes all that it reads for gospel truth, has arrived at the opinion, as expressed by the learned editor of *Harper's Magazine* in the current number of the volume, when he says or intimates that electricity is a fiery, untamed steed, which cavorts, shies and otherwise is untamable in the hands of its present rider. In more graphic English, that the electricians of the present day are a lot of *chumps* who don't know their business, and the public can in nowise rely upon them.

On the other side of the water, they are now vigorously discussing this very question, and our learned contemporaries are abusing each other in the most unintelligent manner. There seems to be no liberal discussion of the subject, but merely an exchange of abuse. In fact, after reading the late articles in the ELECTRICAL REVIEW and *Electrician*, we felt that the discussion was taking a direction similar to the famed one between the two Western editors, when editor No. 1 remarked in his journal that editor No. 2 was mean enough to steal the swill from a blind hog, to which editor No. 2 replied, that editor No. 1 was a liar, and that he never tried to steal *his* swill.

THE KANSAS CITY CONVENTION.

The National Electric Light Association scored its first failure at Kansas City in point of attendance of central station men. Out of an attendance of about 250, there were not over 20 men actively identified with station work. It was expected that holding the Convention at this far western point would bring to the front a great many new electric light men—bring new blood into the Association. These expectations were not realized. Less than half a dozen active delegates were recorded as present from west of the Missouri. The absence of so many of the former active workers in the Association was noticeable, and the burden of the discussion fell on a very few, but was valuable and interesting.

The papers were, as a rule, of particular value, and in the majority of cases were sent to the committees to be read, the author remaining in his eastern home. This was a noticeable disadvantage.

The citizens of Kansas City are deserving of the highest praise for their considerate attention and liberality. Every attendant has only praises for the kindness of the citizens of this progressive western city, and in this respect no former city has ever made a better record. The unpleasant condition of the two halls between which the Convention vacillated, was a regretable feature. At no time, except the last day, were the halls comfortably heated, and the unpleasant sight of delegates wearing their hats and overcoats, shivering in their seats while endeavoring to acquire information that they had traveled many miles to receive, was ever present.

The meetings were without the acrimony that has often characterized them in the past, and the Convention in this respect was a model one.

The new president, Mr. Perry, is a man of force and earnestness, and we predict a brilliant and successful administration under his guiding hand. The chairman of the executive committee, Mr. Huntley, is one of the most active and successful younger members of the Association, who will be a strong co-worker with President Perry.

The Navy Department has appointed a commission, consisting of Commander G. A. Converse, Chief Engineer A. S. Greene, Naval Constructor S. W. Armistead, and Ensign Gilbert Wilkes, to investigate the Thomson-Houston electric welding processes for the purpose of ascertaining the adaptability of these processes to the uses of the Navy. The commission has gone to Lynn to commence the investigation. Ensign Wilkes is the electrical member of the commission. He spent two years in the study of electrical science at Johns Hopkins University, and, since the termination of his course at that institution, has been one of the principal assistants to Commander Bradford in the Naval Electric Lighting Bureau. He is about to leave the service of the government and join his fortunes with the Edison Company, in the Canadian field. His headquarters will be at Toronto, where the Edison Company is concentrating its Canadian business.

SUBMARINE CABLES.

We are glad to see that the English Institution of Electrical Engineers has solved peacefully the question recently raised by a large group of its members as to the apparent neglect of submarine and land telegraph interests. The institution was founded by telegraph engineers and for many years consisted almost entirely of telegraph engineers, as no other branches of electrical engineering were then known. Of late years, however, the telegraph men have been gradually crowded out, as regards representation on the council and general participation in the affairs of the institution, by the electric light men and the "professors," and a short time ago a perfect storm of complaints broke out about this and a schism in the ranks was threatened, the telegraph members proposing to secede in a body and found a society of their own.

Such a serious calamity has happily been averted, however, and unity and concord once more reign supreme. Sir James Anderson, Sir Albert Cappel, and Sir Henry Mance, all eminent telegraph engineers, have been elected to the council, and at the last meeting of the institution, Sir Wm. Thomson, the retiring president, in his farewell speech, laid particular stress on the achievements of submarine cable engineering. He pointed out that electrical engineering had originated in submarine cable enterprise. And this is undoubtedly true. Later branches of the industry owe more than we generally recognize to the pioneer work done in submarine cable laying. Before that time, as Sir Wm. Thomson said, electric telegraphy had hardly a better claim to be considered as engineering than had bell hanging. Sir William touched upon the numerous and discouraging difficulties encountered in the establishment of the Atlantic telegraph, and said that had it not been for the persistent, strenuous and self-sacrificing determination of such men as Mr. Cyrus W. Field and Sir John Pender, the enterprise would have died after the failure of the first cable. In conclusion, he said that in Europe, the Americas, Egypt, South Africa, Japan, India, etc., no less than 1,714,000 miles of land telegraph had been constructed, and the estimated value of these was over $258,000,000. Of submarine cables over 120,000 nautical miles had been laid down, representing a capital of about $200,000,000.

Submarine cable work is a fascinating branch of electrical engineering, and with some of the members of the institution, we cannot help regretting that we do not hear more about it. In the early days of ocean telegraphy, the laying of a cable attracted a vast amount of attention on all sides. Nowadays such an event has got to be so much a matter of course, that those who have built up the industry go quietly on laying down some four or five thousand knots of cable in all parts of the globe, and the only recognition of the work when completed is the insertion of a note in the papers stating that telegraphic communication has been established with such and such a place, of outlandish name, and the rate is so much per word.

"BUGS."

"There's a bug in that somewhere," recently remarked in our hearing a thoughtful young electrical engineer, as he pored and pondered over some rough diagrams of apparatus and circuits, none of which seemed to solve the problem of the moment satisfactorily, and the remark caused us to indulge in some reflections as to how the word "bug" came to be included in the electrical worker's vocabulary.

In electrical parlance on this side of the Atlantic, a "bug" is a difficulty to be overcome, an obstacle to the efficient working of any scheme, an overlooked detail which spoils the harmony of a carefully thought out plan (and this is the most aggravating species of "bug"), a hitch, a defect in a piece of apparatus, or a fault which develops in working later on, all of these are "bugs," and the electrician has to keep a sharp lookout for them all the time. How did the word, laconic and expressive enough in all conscience, come to find its way into the domains of electro-technology? Who was the happy originator, and how did he forge a connection between insects and practical or theoretical difficulties encountered in the pursuit of his profession? Is "bug" in the electrical sense, merely a contraction of bugbear or bugaboo or humbug, or did it take its place among electrical terms just as it is, without passing through any process of abbreviation?

A possible origin that suggests itself to us is this: Scene.—Operating-room of telegraph station anywhere in America. Time.—Twenty (or more) years ago. Operators discovered in various positions, one of them being under a table remedying certain defects in the wires which affect the working of his instrument. A companion observing him, and with a lively recollection of a somewhat similar scene in his bed-room in which his landlady, armed with a kerosene can, figured as destroyer of the tormentors of his sleeping hours, ventures the remark: "What are you doing, looking for bugs?"

The expression "catches on" in the office, and thereafter any one engaged in overhauling instruments, batteries, or circuits, is "looking for bugs." With the wires at hand the new term is soon flashed over the length and breadth of the land, and 'ere long becomes a recognized unit of electrical phraseology, just as well known as, and far more expressive than "volt." No electrician can get along without volts, and few, we fear, manage to without bugs.

Our cousins across the water never say "bugs." It's not "good form." In fact it is considered a nasty word. They do not use the term, as applied to insects (as applied to electricity they do not use it at all), generically, as we do, but specifically meaning bed bugs. Even then they abstain from saying the word itself, but call them B flats (in distinction to F sharps), or Norfolk Howards. This latter expression had its origin as follows: A worthy Britisher named Bugg, felt the infliction of his patronymic so acutely that he decided to change it, and duly announced through the columns of the press that he would hereafter be known as John Norfolk Howard instead of as John Bugg. Norfolk is the title of the premier duke in the British peerage, and Howard his grace's family name, and the conceit so tickled the English fancy that bugs have ever after been known in polite society as "Norfolk Howards."

Nevertheless, and although in England "bug" only means a certain and very nasty species of bug, the Welsh word *bwg*, from which bug is derived, means also a hobgoblin or a scarecrow. So that if our English *confrères* should charge us with a want of nicety in the choice of our technical terms we refer them to Webster. But we have a still stronger defence and better authority in Shakspere, who makes one of his characters say:

"Sir, spare your threats.
The *bug* which you would fright me with I seek."

Here we see the word used in almost exactly the same sense as the electrical man gives it to-day.

Construction of Central Stations.

BY C. J. H. WOODBURY, OF BOSTON.

While acting in co-operation with a committee of the National Electric Light Association, several years ago, it was necessary to examine into the matter of the construction and surroundings of a large number of electric lighting stations. Although these stations were built for the same object, and contained machinery and motive power devoted to the same industry, yet there was a diversity in their characteristics which was wholly inconsistent with their similarity of purpose.

In accepting the invitation of your president to present a paper for consideration at this meeting, it appears that the subject of central station construction might be a profitable one—not by reason of what may be contained in such a paper, but on account of the valuable experience which would surely be offered by the members participating in the general discussion of the subject, and in such a connection, this paper is to be regarded as the opening of the discussion, hardly more than a parliamentary necessity, in order to bring the subject into a debatable form.

Many of the electric lighting stations in large cities have been built under easy financial conditions, where it was feasible to adopt suggestions for convenience, strength and safety, offered by the engineers in charge of such work. Notable examples of such stations have been presented before this Association, or illustrated in the electrical journals. The opportunities for large stations have thus far been so few, and the governing conditions so diverse, that the problem requires in each instance an independent treatment, and is, therefore, unsuited for a general paper on the subject.

The larger part of the electric light stations are of moderate size, and were constructed under conditions of limited resources which often compelled parsimony in the reduction of first cost, and did not permit the exercise of that judicious economy which yields the greatest return on investments.

A most important element in the arrangements of a central station should be the guarantee of continuous operation, in order to give patrons a necessary confidence in the stability of the service, which must be instantaneously equal to the maximum demands of customers.

Many of the stations are in close proximity to other buildings of a miscellaneous character, and are built with hollow frame walls and thin roof, forming a structure which is hot in summer, cold in winter, and combustible all the year 'round—which disadvantages diminish dividends.

The location to be desired for a station should be, first, away from a proximity to other buildings, and therefore free from a fire hazard due to surrounding exposures. It is important that the engines should be provided with an independent condenser, but it is not necessary that the station should be near a water course to obtain a supply of water for the condensers, as is the universal custom in this country. A reservoir of suitable capacity, and not over eight feet deep, will furnish a supply for condensers, which can be used over and over; the condensed steam and hot water entering one side of the reservoir, and the supply for the condenser being taken from an extreme side. If the water should not cool rapidly enough, it could be delivered from the condenser upon the top series of several nearly level platforms, thus flowing upon one and thence to the next in turn. In this way the water rapidly cools. Although the condensing capacity of such reservoirs might differ in this country on account of climatic differences from European practice, yet it is well to note that in winter, when the short days cause the greatest demands upon a central station, the condensing capacity of such a reservoir would be greatly increased by reason of the more rapid loss of heat during cold weather.

In its general arrangements, a central station may be regarded as an engine room, and if well adapted to engines and the delivery of power, there cannot be much difficulty in providing accommodations for dynamos. The type of building suggested for consideration in its application to central station service in small cities, is the one-story with flat roof, lighted by a longitudinal monitor, one end of which extends high enough to form a wire tower. It is not claimed that there is anything original in this design beyond a few minor modifications pertaining to its application to this specific purpose, for it is well known that beginning with one-story machine shops over 25 years ago, foundries, textile and paper mills, on the same general idea of construction, have been widely introduced, wherever the cost of land was low enough to permit the erection of a one-story structure without raising the whole cost of the floor area, including the expense of land, to a price exceeding that of a high building.

The question of foundations does not pertain to this paper, but the importance of suitable foundations is too often slighted.

Franklin once said that next to a good foundation, a good roof was the most important part of a house. The question of roof will next be considered, leaving the intervening pillars and walls for later reference.

The most convenient width for stations using an engine to every pair of dynamos is 43 to 45 feet, and the length of the station is in proportion to its capacity. The roof should be of three-inch plank, each 20 feet in length, grooved and splined with hard wood splines one-half by one and a half inches, and laid on roof timbers breaking joints every three feet. In colder parts of this country, liable to temperatures below zero, it is good economy to lay a course of inch boards upon the plank, with roofing felt between. Pine is preferable to other lumber for roofing, as it does not warp so much as other soft lumber, and the roof covering will last better. The roof covering may be of any material for covering flat roofs, but its value will depend upon the quality of the material and the character of the work.

If these methods are followed, such a roof can be relied upon not to give trouble by condensation of moisture in cold weather, but care must be taken not to drive nails up into the plank, because being good conductors of heat, the heads would be cool and moisture collect on them.

Along the middle of the roof, a monitor 10 feet wide, extending to 20 feet from the ends, will afford light and ventilation, while an extension of this monitor at one end to a suitable height will form a most convenient wire tower, if the monitor, in connection with an outrigger, should not be high enough for the purpose.

The roof timbers should be of southern pine, 10x12 inches, and laid 10 feet on centers. They should project 18 inches beyond the walls, and the ends be cut to form brackets supporting the overhanging roof and forming a solid cornice. At the ridge, the two beams should be secured together by a junction bolt, and supported by column and bolster.

The walls of the station may be built of brick or of wood. If of the former, a 12 inch wall will answer, with windows arranged as may be desired; but if of wood, each roof timber should be supported on an eight by eight inch timber reaching to the sill, and secured to the roof timber by an iron brace, and to the floor timber by iron dogs.

If the building is to be used for apparatus generating low tension currents, the best floor would be made by laying coal tar concrete on a foundation of broken stone or cinder, and then laying three-inch plank upon the concrete, and covering this plank with one and a quarter inch hard wood plank laid across the bottom plank and blind nailed to it. Such a floor would sustain any weight liable to be placed upon it, but where there is need of a mass to hold rapidly moving machinery, it could be cut away wherever it might be necessary to lay heavy foundations.

On the other hand, if the generation of high tension currents in the station imposed electrical conditions requiring a higher insulation of the floor, such as could be obtained only by an air space underneath, then it would be necessary to enter into a larger expense, and to lay a mill floor by placing the two thicknesses of planks on beams in a manner similar to the method described for the roof.

If the dynamos were placed on independent foundations, this floor would be strong enough, but if it should be required to sustain very heavy loads, there should be a line of piers supporting the beams under these loads. The lower portion could be made into a supply room; or otherwise, the front of the building could be divided by a light sheathing partition into a supply room and an office.

In its appointments, the building should be heated by two coils of three lines of one and a quarter inch pipe, each hung about three feet below the roof timbers, the arrangement of piping using exhaust steam for such a building being about one foot of one and a quarter inch pipe to every 70 cubic feet of space. Two coils are suggested, because the side occupied by the steam engines would rarely need any heat from the pipes.

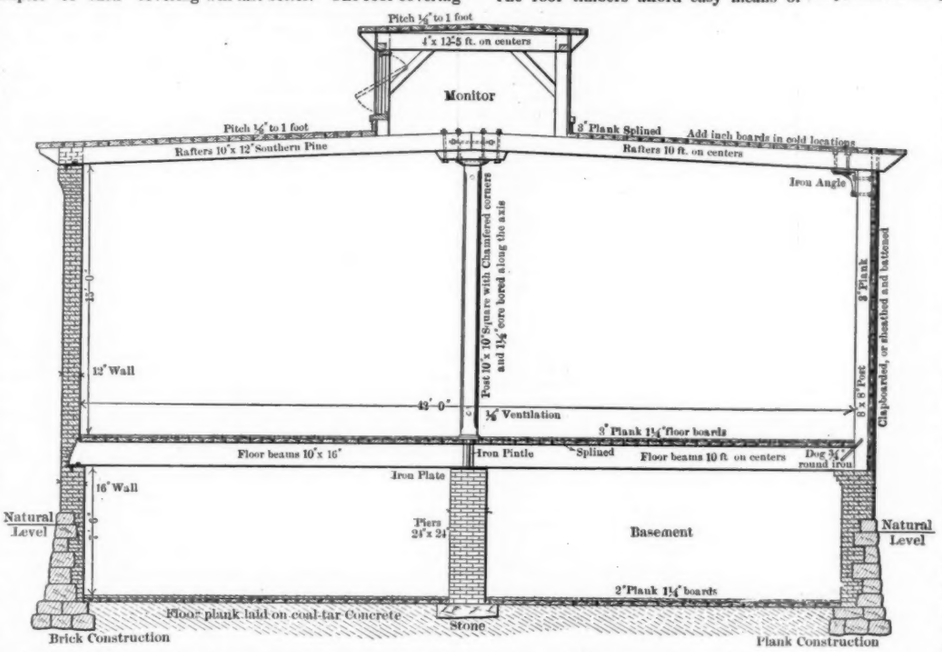
The roof timbers afford easy means of securing a trolley track for making any changes and removing the apparatus or parts of the engines.

The protection against fire consists principally in keeping the establishment in a clean and orderly condition, the use of good lubricating oil, and careful attention to the bearings; and beyond that, numerous fire pails kept filled with water, and hose connected to hydrants ready for instant use, form the means of protection against fire.

If the boiler house is placed at one corner of the station, the latter can be extended by increasing its length; but if the boiler house is placed at the end of the station, the division wall should be made of brick and extend through the roof, entirely cutting off all wood communication between the station and the boiler room.

The wires could be run from the dynamos diagonally upward to the roof timbers, thus clearing the trolley track, and thence under the monitor from beam to beam to the switchboard on the floor under the front end of the monitor, which forms the wire tower. This switchboard would be at the end of the unavailable floor space used for belts, and being in the middle of the room is away from the walls, where any combustible material is likely to be placed. It is important that the switchboard should be made of soapstone or other incombustible material.

It is submitted that a station built in accordance with these general suggestions would embody the merits of convenience in operation, slight need of repairs, and, whether built with brick or plank walls, would possess a resistance to fire which would reduce the fire hazard to a nominal amount; and although not so cheap in its first cost as might be made by using a lighter construction, yet, as a whole, it would conform to the strictest conditions of economy in a building to be used for a central electric lighting or power station.



PERSONAL.

A novel wire conduit is the patented invention of H. H. Carpenter, who proposes to box in the groove in the side of an ordinary street car rail with a plate of iron and pull cables into the conduit so formed. The experiment has not yet been tried.

Lieut. Lucian Flynne has been transferred from Norfolk to the New York Navy Yard. At the latter place he will superintend the construction of the electric lighting plants on board the "Vermont," the "Vesuvius," the "Miantonomah," and in the Yard.

Lieutenant F. W. Toppan sailed last Saturday, for Europe, to be gone three or four months. The Lieutenant took passage on "La Bretagne," of the French line, and received the well-wishes of a number of his friends who had assembled at the pier to see him off.

The late Henry W. Grady's paper, the Atlanta *Constitution*, speaks thusly about electricity: "It is all right—steam frightened people when it was first introduced. It still destroys and kills, but we must have it. So it is with electricity. It is a necessity, and we are going to regulate it."

Wednesday morning, February 12th, Gen. O. E. Madden, president of the Electric Club, departed for Europe on the elegant steamer "Lahn," of the Norddeutscher Lloyd. A goodly number of the General's friends assembled at the pier to bid him God speed, and the start was made in a very auspicious manner.

A new use for the electric light has been proposed as a help toward street traffic in London during the fog season. It is suggested that an incandescent light, fed from a battery in the vehicle behind the animal, should be placed on the forehead of a horse, so that a brilliant ray should be cast in front as a protection to pedestrians.

Mr. C. A. Pillsbury, of Minneapolis, is reported as saying: "I would be satisfied to take as my income the money I believe I could make by generating electricity by water power for motive or illuminating purposes, and selling it at what it would cost to make the same electricity by steam. Even on the basis of the last four years, when the water has been low about a fourth of the time, this would show a great profit."

The veteran telegraph line builder of Washington, Paul D. Connor, has shown himself to be a good constitutional lawyer. One day last week he had a few men out stringing about half a mile of wire, when the whole gang was arrested and arranged before the police court for violating an act of Congress, forbidding the construction of any overhead lines. The evidence was conclusive, and the judge was about to make an example that would forever stop such outrages, when Connor proceeded to argue the case. He soon convinced the court that the law prohibiting the erection of wires contained no provision for punishing violators and, furthermore, that the act was unconstitutional. The judge reluctantly admitted that he would have to let them off this time, and Connor replied: "*Thank ye, yer honor, may I now go and finish me job?*" The job has been finished. A curious thing connected with this business was the fact that the *Evening Star*, which keeps up a steady warfare against the "wire nuisance," in this instance had nothing to say. The explanation is that the men, when arrested, were running an additional wire to connect the *Star* office with the Associated Press, which the *Star's* increasing business rendered necessary.

Telephonic News

⁂ On Tuesday, Feb. 11th, Mr. Thomas Alva Edison celebrated his 43d birthday, having been born in 1847.

⁂ Bethlehem, Pa., is to be connected with the American long distance telephone and telegraph line, which extends from New York to Reading via Morristown, Phillipsburg, Easton and Allentown.

⁂ Salem, Oregon, is soon to have a first-class telephone system. New instruments and circuits are to be provided throughout the entire city, and will be running in a couple of months. Meantime the old line is being repaired.

⁂ L. D. Parker, representing the Postal Telegraph Cable Company, authorizes the statement that his company will connect with Denver as soon as construction can be accomplished. The cost of the extension is estimated at $200,000. It may be looked for towards the first of April.

⁂ The San Francisco Underground Conduit and Electric Company have petitioned for permission to lay down conduits in the public streets for the transmission of messages, sound and signals, and the production of power, heat and light, by the aid of electricity.

⁂ He had been having a lively time with the telephone:

"Hello, Central," he called out in a tone of desperation. "How much does one of these telephones cost?"

"Do you want to buy one?"

"No; I merely wanted to get an idea of the expense before I demolished the confounded arrangement with an ax."

⁂ Cape May is now in a fair way to secure a telephone line from Philadelphia and Camden. The proprietors of the Hotel Lafayette, at Cape May, are moving in the matter, and have the plans for obtaining subscriptions already under way, and have secured a number of subscriptions for phones. The line is expected to cost $4,000 to build, and the phone rental will be $48 per annum.

⁂ Experiments are being made by the Southern New England Telephone Company with a safety fuse which is to be placed on all the wires as they enter buildings. The fuse is to protect the building from fire. It is so constructed that in the event of a cross or contact between a telephone wire and an electric light or other strong current wires, the fuse will melt off and leave the wires cut off from the building, thereby assuring safety.

⁂ The Southern New England Telephone Company is about to issue notes to the amount of $100,000 for the purpose of paying off mortgages and other indebtedness of the company. The notes, which will bear five per cent. interest, will be of denominations of $500 and $1,000. They will be payable in five years, but the company retains the privilege of taking them back in two years. Only stockholders will have the option of purchase.

⁂ Supt. J. P. Barrett, of the Chicago Electric Department, claims to have discovered a successful method for ventilating the electric wire conduits in order to prevent the occasional explosions in manholes. In a letter to Supt. McGann, of the street department, who is investigating the subject, he says: "I have heard several theories advanced, but I know of nothing more practical than the ventilator in use in the city hall, which is a duct connecting the subway with the chimney. This ventilates the subway for several blocks from the city hall. I think this scheme might be applied very generally throughout the city, and would be a practical and easy solution of the problem."

The National Telegraphing Tournament.

In addition to the subscriptions for the National Fast Telegraphing Tournament, which have been published, the Western Union Telegraph Company and its general manager have placed themselves on the list in a manner deserving of public announcement, being especially interesting to the craft. It is shown in the following correspondence:

NEW YORK, Jan. 29, '90.

GEN. THOS. T. ECKERT, V. P. and G. M.:

DEAR GENERAL—Arrangements are being made for a National Fast Telegraphing Tournament, to take place in this city in April next.

The United Press, Associated Press, The E. S. Greeley & Company, J. H. Bunnell & Company, Western Electric Company, *Electrical World* and *Electric Age*, have given me assurances of substantial support. These contests are far reaching in the matter of elevating the standard of the profession; consequently, a direct benefit to telegraph companies.

May I count upon the co-operation of our company? Very resp'y yours,

FRED. CATLIN,
Mgr. Nat. Fast Tel. Tournament.

EXECUTIVE OFFICE, W. U. TEL. CO.
NEW YORK, Feb. 11, '90.

FRED. CATLIN, ESQ., Manager Tel. Tournament, New York City:

DEAR MR. CATLIN—Your notes of January 20th and 29th were duly received, and I regret that my answer has been delayed, by an illness which has kept me away from the office, and the subsequent rush of business upon my return.

It gives me pleasure to send you herewith a check for $100, as the company's contribution to the prizes to be competed for, and to add thereto my check for $25.

I need not say to you, and through you to the operators generally, that I take a great interest in the tournament, which will show flattering evidences of their skill, and of the possible achievements of the best equipped men on the lines.

I hope that the tournament will be in every way a great success, and that the best man may win. Yours very truly,

THOS. T. ECKERT,
V. P. and Gen'l Manager.

195 BROADWAY,
NEW YORK, Feb. 11, '90.

THOS. T. ECKERT, V. P. and Gen'l Manager:

DEAR GENERAL—With sincere thanks I hereby acknowledge receipt of check for $100, a contribution from our company to be added to the tournament prizes, also your personal check for $25 for the same purpose.

Still more than these, do I value your expressions of cheerful co-operation in, and hearty sympathy with the affair, and in this feeling I know I voice the sentiment of the fraternity throughout the country.

I trust the result of the contest will fully justify your expectation.

Yours very truly,
FRED. CATLIN,
Mgr. Nat. F. T. Tourney.

It has been suggested that a prize be offered to operators who were in the service prior to 1865, as it would give some of the old-timers a chance to show how well they have maintained their grip. The prize will probably be offered, to be known as the "Old-Timers' Prize." It is to be hoped that other cities will be represented in this National Tournament. Local tournaments can be held, and selections of representatives decided upon, and there should be no difficulty in securing free transportation to come in such capacity.

⁂ The ordinance granting the Northwestern Telephone Company the right to lay a private conduit on the streets has been acted upon favorably by the Council Committee on Streets, at St. Paul, Minn.

⁂ Judge Wurtele, of Montreal, has dismissed the great telegraph suit on the ground that the Canadian Pacific Railway should have been first sued for trespass, and that the Montreal Telegraph Company might have been called upon to protect the Great Northwestern Company in that proceeding. Each company pays its own costs. The judge did not express an opinion as to the merits of the case, whether the agreement was a lease or not, or whether the Great Northwestern Company was entitled to two or three per cent. reduction. Large stock transactions have occurred pending the decision, which really settles nothing. The case will be appealed by the Great Northwestern Company, which, in view of the judgment, will cease paying rental till the question is decided on appeal.

The French Telephones.

From the 1st inst. new regulations have been in force with regard to the French telephones. Since that date the supplementary payment of 50 fr. for inter-urban communication is no longer demanded. By these new regulations all subscribers to lines joined by inter-urban circuits can correspond, from their house and with all the subscribers of the corresponding line, without having to pay a special rent for use of the urban line. They have only to pay the price attaching to each of the inter-urban circuits. This price is granted on a guarantee deposit to be made by the subscriber—a deposit which must be in accord with the importance of the communications likely to be demanded. The subscribers who wish to be admitted to the exchange of inter-urban communications must apply by unstamped letter, addressed to M. le Directeur Ingénieur des Télégraphes, 103, Rue de Grenelle. The following are the prices of inter-urban communications:

	Francs.
Paris—Brussels	3
Paris—Lille	1.50

The duration of the conversation is fixed at five minutes.

	Francs.
Paris—Lyons	3
Paris—Marseilles	4.50
Paris—Havre	1.50
Paris—Reims	1
Paris—Rouen	1

A correspondent can only communicate for ten consecutive minutes if other correspondents be waiting their turn.

	Francs.
Paris—Versailles	0.50
Lille—Dunkerque	0.50
Lille—Cassel	0.50
Lille—Douai	0.50

The duration of this conversation is only reckoned from the time when the two correspondents are placed in communication.

	Francs.
Cassel—Dunkerque	0.50
Lyons—Marseilles	2
Rouen—Havre	0.50
Rouen—Elbeuf	0.50
Rouen—Louviers	0.50
Elbeuf—Louviers	0.50

In cases where the line is occupied at the time a correspondent wishes to communicate, this correspondent may obtain his communication in his turn, which will allow of his estimating approximately how long he will have to wait.

Considerable irritation still exists in Paris as to the working of the telephones, those interested, of course, being the public, the State, and the Société Générale des Téléphones, which latter, by-the-bye, holds an ordinary general meeting on the 29th, the business being to hear communications from the council of management as to the position of the company. In the meantime, it appears that several persons have opened offices in Paris and have offered the Paris telephone subscribers their services as intermediaries between them and the government. The latter, by the aid of its director-general of written and verbal communications, has put the public on its guard against this form of doing business in the following note:

"Some persons have made offers to the subscribers to the telephone of services for repairs to or maintenance of telephone apparatus. This fact having come to the knowledge of the Administration of Posts and Telegraphs, the director, M. Coulon, has just addressed to those interested a circular to remind them that the administration, by the terms of the new contract of subscription, takes under its charge all the expenses of the installation and maintenance of all the apparatus forming the subscriber's telephone post, without its costing the subscriber anything over and above the price of subscription. The telephone post consists of the generators of electricity, of a receiving and transmitting apparatus, and a call. The administration also reserves to itself the installation and maintenance of the necessary apparatus of every description (extra bells, commutators, tables for several directions, etc.), which the subscriber may judge necessary for his particular wants. In order to cover at once the expenses of the installation and keeping in repair of these apparatus, an addition to the subscription, calculated at the rate 15 per cent. on the value of the accessories set up, is collected."

In conclusion, M. Coulon informs the subscribers that the intervention of an electrician, a stranger to the administration, in the repair of the apparatus, is not only useless, but, further, that is contrary to Article 7 of the contract, which says that the subscriber must not dismount or displace his wires, apparatus and accessories.

A Postal Telegraph Scheme.

MR. WANAMAKER'S PLAN.

Postmaster-General Wanamaker was before the House Committee on Post Offices and Post Roads, last week, and discussed fully with the committee the establishment of a limited postal telegraph. Dr. Norvin Green, the president of the Western Union Telegraph Company, and Mr. Chandler, the president of the Postal Telegraph Company, had been invited to attend the meeting, but they were not present. Mr. Wanamaker said he asked the support of the committee in favor of a short bill investing the Postmaster-General with authority to enter into a contract with responsible parties to connect a certain number of post offices with each other by telegraph, by leasing wires and instruments to be operated by post office employés. He was not proposing, he said, that the government should purchase or build a telegraph line, nor the appropriation of a large sum of money from the treasury, nor the creating of a new body of employés, but simply the utilization of the office buildings, clerks and carriers now in use, and by convenience and economy of service greatly to accommodate the public in a business that should not be divorced from the post office, as it was nothing more or less than the carrying of messages. He said he proposed a union of post and telegraph on a basis that in his judgment would not interfere to any appreciable extent with any existing rights, but that would offer incalculable service to classes not now enjoying the use of the telegraph to any large degree. He asked that he be directed to negotiate and secure a set of leased wires, such as the great newspapers have from city to city, so that the common people might communicate through their business offices (the post offices) from city to city, or by messages dropped in their mail boxes. He held, and declared most emphatically, he said, that such a service was the legitimate work of the post office, and that the people were right in stoutly demanding telegraph facilities at postal stations.

In 1847, when the telegraph passed from the control of the Post Office Department, the number of letters mailed was 57,173,000; the number of messages transmitted by the Western Union Telegraph Company in the last year was 54,108,000. The gross revenue of the Post Office Department in 1871 was $20,637,000; the receipts of the Western Union in the last year were $20,783,000. One hundred millions of dollars of net profits had been paid over by the people to this one company in 23 years. The revenues of the Post Office Department had doubled within 15 years; the business and receipts of the Western Union Telegraph Company had doubled in ten years.

It was said that 85 to 90 per cent. of the telegraph business of the United States was commercial and speculative, less than five per cent. family and social, whereas in Great Britain the family and social business was over 50 per cent. of the whole. It was also stated that not more than two per cent. of the people of the United States used the telegraph, and Mr. Wanamaker said that 60,000,000 people should not be taxed to pay a deficit sure to be caused by cheap telegraph rates benefiting 1,250,000 only—rich and commercial speculators. This proposed system would enable the Post Office Department to increase its business very largely, and make more money, and there would be no deficit. He said: "The Post Office Department is not now self-sustaining, because it is charged with carrying free the $5,000,000 to $6,000,000 worth of mail matter of the various executive departments of the government, handling the newspapers of the country for practically nothing, and allowing the opportunity to pass of tranmitting telegraphic messages because there are incorporated companies who dispute the ground, and maintain an exclusive and highly paid service."

He did not want to be understood as saying that his proposed plan would lessen the business of the Western Union. A new business would be created.

NATIONAL ELECTRIC LIGHT ASS'N PROCEEDINGS.

(*Continued from page 3.*)

load is light, a few lights thrown off or on either side will make a big difference in the balance, but, as the total load increases, the number of lamps thrown off or on either side at any one instant is so small a percentage of the total load, that the station needs practically no balancing. Now, if any one station supplying electricity for all purposes in a town, we have say 25 per cent. reserve in boilers, and 25 per cent. reserve in steam engines in excess of the average load, we shall only require to place 25 per cent. reserve, each, on electric light dynamos and power generators to have practically the same result as though we had two complete and separate stations for electric light and for electric power, each with its proper reserve of 25 per cent. extra in engines and boilers and dynamos.

Another important point to be considered, and one well worthy of consideration by electric light stations, is, that in many cases they could furnish this current delivered at the walls of their stations; that is, the car company will take care of its overhead lines and connections, and the electric light companies be paid a rental simply for the electricity delivered to the car companies' lines.

As an instance of what may be done in increasing the output of a station, without a corresponding increase in expenses, we quote the case of a small station, which, as nearly as can be determined from results, shows the following condition of affairs:

The station increased its business in 1889 over 1888, 23 per cent., and in the same time the total expenses, including the extra line work and distribution expenses, 10 per cent., which 10 per cent. meant 10 per cent. increase in running expenses, and 10 per cent. in fixed expenses. The company contemplates a further increase of 27 per cent. on the same basis, this increase, however, being for power furnished alone, without any line work involved, the most careful calculation shows that this will only increase the present running expenses 10 per cent., without increasing the fixed charges at all.

In 1888, the proportion of fixed charges to running expenses was 25 per cent. and 75 per cent., respectively, of the total expenses. In 1889, this same proportion held good, each having been increased 10 per cent., as above stated, and the total expenses having increased the same amount. The further expected increase being 10 per cent. of 75 per cent., will mean an increase in the total expenses in 1890 over 1888, of 17½ per cent., while, in the same time, the total output of the station, and consequent gross receipts, will have increased 50 per cent.

These figures are all taken from the case of a small station, with a total output of some 350 horse-power, and a fresh increase in this station (above this point) will result in an entirely different condition of affairs, so that a readjustment will take place in the proportion of fixed expenses and running expenses; we, therefore, present the report of another station, which is operating 1,200 horse-power., in which the total operating expenses are divided into 80 per cent. running and 20 per cent. fixed. On increasing the station to an output of 1,800 horse-power, the increase to be entirely in the furnishing of power, the increase in total operating expenses would be about 14 per cent., and the ratios of fixed and running expenses would be about 15 per cent. and 85 per cent.

The report of another large central station operating at least 2,500 horse-power, has been divided somewhat differently. The fixed charges are 14 per cent. of the total expenditures. All labor and pay rolls amount to 41 per cent., and all material, such as coal, carbons, lamps, wire, oil, etc., amount to 45 per cent.

Taking in account all their past calculations and experiences, they are very confident that they can operate at least double their present output, be it light or power, at one-fifth more for fixed charges, one-third more for all labor and pay rolls, and say three-fourths more to their present material item, making a total additional charge of say 50 per cent. upon their present expenditures, and giving them in return at least double the gross income. As stated before, it will not be found advisable to calculate upon using the same engine, boiler and dynamo power for the double service for lighting at night and power during the day-time, except, of course, in some few isolated cases.

The great saving for the central station company lies in the reducing in labor and fixed charges, and also that the reserve power for one will suffice for the other. Your committee feel that a great step has been taken in the right direction in securing the endorsement and co-operation of the largest and leading companies, and they would suggest to the Association that some measures be taken to secure from the stationary motor companies the adoption of some standard potentials for their use upon constant potential circuits.

EUGENE T. LYNCH, JR.,
129 Broadway, N. Y.

SECOND DAY'S PROCEEDINGS.—FEBRUARY 12th, 1890.

MORNING SESSION.

The Convention was called to order in Music Hall at nine o'clock, President Weeks in the chair.

Secretary Garratt read the following communications:

To the President and Members of the National Electric Light Association:

The Metropolitan Street Railway Company respectfully offers to the members of your Association the privilege of riding free over its lines, and orders have been issued to conductors to honor the badges worn by members accordingly.

Your members are cordially invited to take a trip over the Armourdale Electric Line at their convenience. Hoping that we may be given notice of your pleasure in the matter so that we may be able to make special arrangements for your accommodation. R. J. McCARTY, General Manager.

On motion the courtesy was accepted, and the communication was ordered spread upon the minutes of the Convention.

Secretary Garratt read the following:

To the National Electric Light Association:

The following resolution has been passed by the Missouri State Association of Architects, now in session in Parlor S, Midland Hotel:

"*Resolved*, That the courtesies of Missouri State Association of Architects be extended to the members of the National Electric Light Association, now assembled in Kansas City, and that they be invited to inspect the exhibit of architectural drawings in Parlor S, Midland Hotel." Respectfully,

JAMES OLIVER HOGG, Secretary.

On motion, the matter was referred to the executive committee, with power to act.

The Chairman: The first thing on the programme this morning will be the report of the committee for the abolition of customs duty on copper, which will be presented by Mr. George W. Phelps, of New York.

THE REPORT OF THE COMMITTEE ON ABOLITION OF DUTY ON COPPER.

Mr. Phelps presented the report of the committee as follows:

The committee appointed at the last meeting of the National Electric Light Association to petition the proper committee of Congress for the abolition of the duty on copper, appeared at Washington, January 16th, through Mr. Phelps, who presented the following petition to the committee on ways and means, with the subjoined address.

Petition to the Honorable Committee on Ways and Means, House of Representatives, U. S. A.:

The subscribers were appointed a committee to petition your honorable body for the abolition of duty on copper ingot, plate, bars, rod and wire. We represent the National Electric Light Association, a body composed of representatives of electric lighting companies throughout the United States, and also of manufacturers of, and dealers in, electric lighting apparatus and supplies.

The resolution appointing this committee was passed without a dissenting voice. We, therefore, have the honor to present this petition, earnestly requesting that the action asked to be taken as a measure which will be approved by the great body of users and manufacturers of copper.

(Signed) CHARLES A. BROWN,
GEORGE M. PHELPS,
J. F. MORRISON.

Then followed the report which was published in the ELECTRICAL REVIEW in a recent issue.

President Weeks: Gentlemen, you have heard the report of the committee. It is now before the Convention for general discussion. Is there any one present who would like to speak to this question? It is a very important question, a matter, that if properly followed up, will open a large field for the products of central stations. Whatever gives us a market for our current is of vital importance to every central station man. I should be pleased to hear from any one on this topic.

Dr. Mason: Will you allow me to suggest that, while the members of the Convention may not now be prepared to discuss the question, it is too important to pass over, and perhaps it might be well to assign an hour in a future session to be devoted to the matter brought before us in the paper.

President Weeks: The suggestion of Dr. Mason is very pertinent, and I think it can be met in this way, that we will have a general discussion of this topic at the same time that we have a discussion on Mr. Sprague's paper on electricity as applied to street railways. Therefore, we will pass that for the time being, and we will hear from Mr. P. H. Alexander, of New York, the report of the committee on harmonizing insurance and electrical interests.

Mr. Alexander then read the report of the committee as follows:

INSURANCE OF ELECTRICAL INTERESTS.

The Committee on Harmonizing the Insurance and Electric Lighting Interests was continued at your session, held at Niagara Falls last August, and requested to confer once more with the fire underwriters regarding the best means of preventing fires from electricity, and to try and bring about a reduction of insurance on the buildings lighted by electricity. The committee has had many sessions, and a great deal of correspondence with fire underwriters, and can only reiterate the recommendation made at the last meeting of this Convention regarding the desirability of examining and licensing men employed in electric lighting, and would further recommend all electric light companies to contribute towards the remuneration of several expert electrical engineers in different parts of the United States, who should instruct special agents or inspectors of insurance companies in the necessary knowledge to discern between good and bad electrical installation.

The committee thinks that special agents and inspectors of insurance companies ought to qualify themselves in inspecting electrical installation, as far as fire is concerned, the same as they qualify themselves in inspecting other appliances put up in buildings, and judge of their relation to fire hazards.

The committee realize that as long as inspectors are employed at the expense of the electric light companies, underwriters will take no pains to acquire for themselves the necessary knowledge to inspect such risks.

The committee would, therefore, recommend to electric lighting companies the appointment of an instructor to special agents for a period not exceeding one year, feeling certain within that time every special agent and inspector of fire risks could acquire all the necessary knowledge to enable him to judge of electrical installation as far as it applies to fire hazards.

The committee has communicated this, its ideas, to underwriters' associations and insurance boards, but must confess that it has not met with the favorable responses to this proposition that it anticipated; however, the insurance interests seem to be willing to take some steps to bring about the harmonious relations so much desired.

Your committee was also instructed to report upon the advisability and feasibility of a mutual insurance company for insuring central stations.

A plan was proposed by Mr. S. E. Barton and Captain William Brophy, both of them well-known to you, for the establishment of such a mutual insurance company, a prospectus of which is filed herewith (see Boston Letter in ELECTRICAL REVIEW, of February 8), and has been forwarded to the members of this Association.

The committee, after carefully considering the plan of operation as prepared by these gentlemen, has unanimously endorsed their ideas, as have a great many central station men of note, members of this Association, as well as the Association of Edison Illuminating Companies.

The plan proposed will not only reduce the cost of insurance, but will aid in perfecting the construction of central stations; and, by frequent inspections, will aid the managers of such stations in the knowledge of modern appliances.

Your committee would be glad to have this matter freely discussed here to-day, to see if the project is not worthy of the official endorsement of the National Electric Light Association.

The Committee, by its Chairman.

Kansas City, Feb. 11, 1890.

Mr. George Cutter, of Chicago: I propose to speak to you simply in an off-hand manner. I feel free to do so, as I have almost the courage to put myself before you as the mouthpiece of the electric light men in the West. We have looked East for information as to harmonizing electric light and insurance interests. We feel, to-day, that this is necessary, and that we will derive a great deal of good, both the insurance interests, and the electric light interests, from action of this kind. A thing of great importance to us in the West is to have this movement pushed rapidly forward, so that our electrical engineers will know what is best for the best class of work. We have constantly cropping up before us, people who want their work according to insurance rules. We have no insurance rules. I should say we have a variety, but one engineer works upon one line of insurance rules, and another engineer follows another line. For instance, a short time ago, a movement was started in Lake View to compel putting wires underground. As a sort of compromise it was published in the papers that a compromise was made by which the wires were to go under the street and then over the housetops. In some insurance rules, special mention is made that the wires should be kept away from the buildings, and this appears to us as all-important.

I feel that if a committee composed of electric light men and insurance men would work together to outline a national line of rules to influence the electric installations all over the country, we would all be benefited by it. The necessities of the case have given rise to the growth of another line throughout the West, that of consulting engineers. The uncertainty amongst purchasers of electric light plants from the many contradictory statements made by salesmen has made a demand for consulting engineers in the West, and this demand is being filled in a very unsatisfactory manner. They are opening offices in different places, and traveling about as consulting engineers, and among them are many who have no practical experience whatever in putting in installations. They drift around and talk with one party and another, and in that way get a little information.

I feel that in connection with this committee, in the same line of thought which is advanced in the report, a superintendent of installation should pass an examination. This would sift out these so-called electrical engineers, whose knowledge extends perhaps to the putting up of a vibrating bell somewhere, and who know absolutely nothing about electric light plants. The inspection of an electric light plant requires experience in installing the same and in handling the apparatus, and that would be one point to be taken into consideration by a joint committee working in harmony. Now, the thought that I wanted to express is as to the value of a standing committee composed of electric light and insurance people working in harmony to keep pace with the growth of our industry, so that we may know the best method of installing the apparatus.

New ideas are being advanced constantly, and there is a diversity of opinion as to the correct use and installation of apparatus. This committee should be ready at all times to act, and should very carefully study the question, so that they may outline the proper rules.

It seems to me the question divides itself practically into two parts: One, the insurance of the central station, in which the situation becomes simply that of buyer and seller; second, insurance outside of the central station. There our interests are identical. The electric light companies want that work well done, so that they will have no unnecessary expense and so that the public will feel that they will have no accidents. The insurance people also want the same thing. Their interests are identical, and it is in this line particularly that a committee consisting of members of both branches working in harmony would accomplish a great good. Therefore, the consideration of the question could be left to a committee appointed by the National Electric Light Association, and representatives of the insurance companies. In all probability that committee would consist of members in different sections of the country, so that the tendency of sentiment in each section would be represented in that committee. Such a committee would soon get a thorough knowledge of the various rules for installation throughout the country amongst the electric light people, the underwriters and the architects, and this, together with the knowledge of the members of the committee, would bring about the adoption of a set of uniform rules which would control our installations all over the country. In this way the people of the small towns in the country would have the advantage of knowing what the insurance rules were, and would have the means of knowing what proper installation is. The result would be that the public would finally gain that confidence in electric lighting which it deserves, and the purchaser of an electric light apparatus would have information as to what good installation is. Therefore, this committee which we appoint now, should work in connection with the insurance people, looking to the establishment either of a standing committee or some board which would be a body to whom should be referred important questions for final reference in relation to installation.

I think such a body as that would ultimately become a great power in the land, and with careful work would make our business known to the people and do away with the scare which exists to-day, and would also check the growing tendency amongst politicians to interfere with our work. They are finding that it is profitable, and the more they find that out the more will they interfere with us and our rules unless we have a power derived from an influence obtained through public opinion, which will check this interference by politicians that would be disastrous to our industry unless it were checked. (Applause.)

Mr. T. Carpenter Smith, of Philadelphia: I am very much in favor of such a committee as has been recommended. I represent a company in what is usually called a pretty slow going town, but notwithstanding that, we have made progress there. In Philadelphia, we have an insurance inspector, who has taken a very original course, and absolutely refuses to lay down any rules for wiring, on the ground that just as soon as an absolute rule is made, just so soon will be found the means to evade it. He has also been opposed very much to the licensing of wiremen, on the ground that while you may very easily control, by a license system, the extent of a man's knowledge, you cannot control his trustworthiness. We have men who are doing wiring as contractors in Philadelphia, who can pass any examination which can be made. Yet those men will deliberately splice underwriters' wire on the inside of a building, and splice water-proof wire on the end of it, where it

comes out, and they will even wrap tin foil around it, so that it looks as if it was soldered. (Laughter.) Now, no licensing system will control men like that. These are the points which, I think, the committee should take very carefully into consideration when they try to draw up any set of rules.

After all, it comes down a great deal more to common sense than electrical knowledge in doing wiring, especially about central stations. At one time, in the early history of the art, underwriters' wire was cleated to the floor, and run through a house without any rubber around it, and it was thought that was good enough. Then we got a great scare about the water-proof business, and everybody lumbered up space with rubber-covered wire and other things. Then we got to running rubber-covered wire on glass insulators, and thought that was just the thing; but a day came when we found that the rubber cover carried the flame better than the electricity did. Now we have got down to porcelain and glass insulators. We have begun to find that our old despised friend, the underwriters', is not a bad thing to go through a building, because, while it may get wet, it will not carry the flame. I think 90 per cent. of the cases occurring in Philadelphia come from the flexible cord which has been handled until all the strands are broken, and all at once a little blaze is discovered in the ceiling. The people then, instead of knocking it down and throwing a bucket of water on it, run out of the room, and before anything is done to check it, it has got a great deal of headway and makes trouble.

Now, we are going through a little circus in Philadelphia with regard to underwriters' inspection, and a scheme has been formulated which has the germs of a very good system in it. The electric light companies cannot compel a customer to have his building wired properly. If they attempt to do anything of the kind, the customer says: "I will get some other company to do this," and after the work has been once done in his building, no matter how dangerous it is, you cannot get him to change it. There are so many advantages in coming under the law of common carriers that I think it will be found on examination to outweigh the disadvantages, if we can only get some way of compelling customers to put the wiring in their buildings in a safe condition.

There is no question but that the insurance people can compel a customer to do anything. The worst class of customer we have to deal with is the very one who is scared the most about having insurance taken off his building, and a mere suggestion or hint from his insurance company that they will not continue his policy, will bring him to terms in a moment. I think, therefore, that we should attempt to throw the *onus* of all compulsory work on the insurance companies. It does not affect their business a particle. They can put a man's premium up two per cent., and it makes no difference; they can get his insurance just the same, because they are a strong body, and when they have agreed to do a certain thing, they do it, and no man can afford not to have his place insured.

We are talking of an arrangement which I think will go through, whereby the electric light companies are to pay an annual sum to the insurance companies for every arc light installed, and for every incandescent light installed. This is to apply to the maintenance of a staff of skilled inspectors, who shall not merely inspect all new work, but shall periodically inspect all work already installed, so that any changes may be examined, and any man who is found sticking 50-candle lamps on a wire that was meant for 10, can be detected, and this will be stopped by a power that is greater than the power of the electric light men—the threat of withdrawing their insurance. On the other hand, the incandescent men will also compel the owners of all incandescent lighting plants and arc insulating plants to pay them that higher rental.

The matter really comes down to this: That a certain sum has to be paid every year for skilled supervision and inspection of all new work and all work already installed, the costs of this inspection to be divided *pro rata* among every user of incandescent and arc lamps, the only difference being in the case of people who are supplied from central stations, that the central station shall bear that expense. Now, as a central station man, I think that the cost of such a system would be 10 times paid to an electric lighting company every year in the satisfaction they would have of knowing that somebody else was responsible for the condition of their numerous wires. An electric lighting company has enough to do to get the current out on the line and make money out of it, without having to lay awake nights worrying over the condition of the wire in the different buildings all over town. We must remember that the electric lighting business is a lighting business, and if you make money in it, you do so, not because the lighting is done by electricity, as a great many people seem to think that because a thing is electric there is millions in it, but you make money in it, if at all, because electric lighting is a very good business. Every business must be run in a businesslike way, that is the experience of the past, and is what we must do in the future, run every business in a businesslike way or the business would never pay. Now, the gas companies have got to a certain condition after 40 or 50 years of hard experience. They did not even get their experience from having somebody sit down and figure it out for them. They started, just as we have, by piping people's buildings, and doing everything of that kind. Gradually, they began to cut off these little luxuries, and now they have got down to delivering gas at the customer's premises; they put their meter in, and are responsible for it, and beyond that they are not responsible, and the electric lighting company must get there, too, just as quickly as possible.

M. J. Francisco, Rutland, Vt.: Mr. President and Gentlemen—In regard to this matter that Mr. Smith has referred to, he has overlooked the fact that in New England we have an association of the very kind that he desires in Philadelphia. It is considered under the name of the New England Exchange, that is, the electric light exchange, and also as the New England Insurance Exchange. The two are working together as one body, practically. That is, the orders of one go into the other, and there are enforced by one organization. Now, then, in regard to this wiring business. If they have the proper man in Philadelphia to examine the wiring, I do not thing they will put much tin foil in place of solder. At least, if they ever try that with Captain Brophy as inspector, they will get terribly left. He is inspector for New England. If you can find a man who will use tin foil and have it pass Captain Brophy, I say, let it go; the line will be all right. But there, we have this plan: They license these men. One of the conditions that has to be considered is the moral character of the man. That man must have a record, he must have a standing, or else he cannot procure a license to do this business. And another thing which is a very important item in regard to this wiring houses and wiring buildings—all such buildings have got to be wired in accordance with the rules of the insurance exchange. After they are wired, the electric lighting company invite the exchange to send their inspector there to make an inspection of these wires. If they are in accordance with the rules of the exchange, as well as of the company, they are passed; if they are not, they must come out, they cannot use them; they have got to take them out and put them in as they should be. The moment they refuse to do that, not only have they got the electric lighting company's order to discontinue the current, but they have the insurance exchange to deal with, and they cancel every policy on that property. There are two bodies back of these rules to enforce them. That is the basis on which all this business should be carried out through the whole United States. These organizations of exchanges and insurance companies should be affected throughout the entire United States. That was the plan discussed at Niagara Falls, and that is one of the objects of this committee in making this arrangement.

Now, one word in regard to this insurance business. I have been engaged in the insurance business for about 25 years, and I have had a good deal of difficulty in getting the companies to believe that electric lighting plants were nice risks, that they were good risks, etc. In the discussion of this exchange business, this matter of these mutual companies has been brought up. We will, of course, run on a stock basis. I have always been a little skeptical, as I have got left once or twice on this mutual business. But in this present association, the one that has been inaugurated here at this Association and practically endorsed, we have an arrangement with the Association practically at the head of it, with two men who have had as long and as varied experience probably as any man in the United States. When you put those men, with their experience and knowledge, at the head of an association of this kind, to effect and carry out these plans, I consider that we have got a plan that we can all heartily endorse, and one which will give us insurance at its actual cost, and give us insurance in a shape whereby we can cover the property, and not have, as a large number of stations are now, our property without any protection whatever. In the last year I have received 150, if not 200, letters in reference to this insurance matter, asking: "Why cannot we get our property insured, and how can we arrange these stations so we can insure them? Can it be so arranged?" Well, of cousre, it can be so arranged, but under present arrangements there is no inspection. The new companies being organized do not know what to do; they are going to put in a station, and, of course they do not understand the rules of the insurance companies, and they do not understand how to arrange these stations, and they may proceed in such way as to destroy their insurance at once. Now, with a proper inspector, he goes there and sees those plans, and points out the defects to them, and says to them: "Now, here, you fix that matter there in proper shape and you are all right; you can get your insurance without difficulty; it will come all right." And that is just the plan, as I understand it, of this mutual combination that is being organized. They propose to have an inspector who will go to your station, examine it, and if he finds anything that is improper, or out of the way, he will explain to you what wants to be fixed, and you go to work and fix it, so that it is all right and you can procure your insurance at once, and you can procure it at a rate which you can live by. I have had letters, numbers of them, from parties who said "the insurance companies are charging us five per cent. on our station." Well, of course, there is some reason for that, as companies do not do such a thing unless there is some reason; but, in many instances, it is because the companies do not understand the rules and principles to apply in arranging the stations to properly protect insurance companies. In many instances that is the trouble. And, too, of course, the insurance companies in a large number of cases have inspectors of insurance risks, who know little or nothing about the electrical part of it. They are thoroughly ignorant in a large number of cases, the insurance companies' inspectors, of the electrical part of the business and the danger of an electrical current. Now, in this case, as I understand it, this inspector is to be a man who thoroughly understands the electrical part of the business and can explain all of those dangers that every station has to meet in running their current and in arranging their station. And I am heartily in accord with the idea, and I trust every station man will investigate the matter and look the thing up, and take hold of this subject in the proper spirit and carry out, finally, not only the insurance part of it, but also this matter of organizing societies or exchanges, for the purpose of combining the interests of the electric lighting people and the insurance people in regard to wiring, and to, in a proper manner, enforce the rights of the association in regard to putting lines of wire into different places, as has been mentioned here. (Applause.)

Dr. Mason, of Boston: Do we understand you, Mr. Francisco, to object to the idea suggested, that there should be a national insurance exchange, as there is a New England Insurance Exchange, and as there are other exchanges?

Mr. Francisco: The idea of that is simply this: A national exchange would be too extended to be practicable. The idea is, as suggested by the committee; for instance, we have now the New England Exchange. Then we will take in the Middle States, then the Western States, the Southern States, so as to make a department each by themselves, the same as the insurance companies do at the present time. In the insurance business we have what we call the Northwestern Association, the Southwestern Association, the Southern Association, the Middle Association, and the New England Association. Now, under this arrangement of this matter, we can carry it forward on precisely the same plan. Divide them up, but have them all under one head in the National Association. Bring them all into this association, but preserve your different departments, because, if you don't, it will be too large to manage economically. It cannot be controlled practically, as the territory is too large, unless we do this. You have got to have it so you can divide it, and so that men engaged can go from one point to another without spending a week or ten days in flying across the country, from the Atlantic to the Pacific. It is an important idea to preserve the different associations, but all to come into this national organization, and this to be the general head.

Mr. DeCamp: The same as the National Board of Underwriters.

Mr. Francisco: Just the same; this National Association takes the place of the National Board of Underwriters.

Mr. J. E. Lockwood, of Detroit, Mich.: I would like to suggest, in support of the idea that has already been advanced, of the harmonizing of the electric light and the insurance interests, a step that has also been taken in the direction of forming State electric light associations. This, it seems to me, is the proper time for the Electric Light Association to make use of the State association for the purpose of getting direct communication with each local organization in the country. The importance of this question depends, I think, in each State, upon the question of the organization of the electric lighting interest in each State and city. As there are electric light interests in each city, so also are there companies in each city, and the National Association is represented in the local organization. I think if this committee is formed, its functions could be more properly performed by creating and formulating the ideas derived from men of experience all over the United States, and which information could be gathered and furnished by the State association. Then let each State association apply in its own State this information, and instruct all of the electric lighting companies and the insurance men throughout the State with the proper rules for wiring; and then, through its own members, residents of every city of the State where there are electric light plants, see that these rules are carried out. In the city of Detroit, Mich., we have had the same thing to look out for. We have just formed a State association for Michigan. We have there a case where there are probably at present, not less than a half dozen different companies doing wiring of buildings, in one of which that I know of, the wires are being concealed within the mortar; and for a single light they are putting in No. 20 wire, which I know is smaller than is thought proper. In a building within one square there they are fitting up, for two lights, No. 10 and No. 8 wire. Now, I believe, although that No. 8 and No. 10 wire for two lights is all right, but on the safe side, that man that will make that mistake may, on the other hand, make the mistake which will create a very great danger. We have, fortunately, not had a great many fires, but we have had our attention called to these facts and to the number of accidents in other cities which have been published in the papers. Our State Association intends making its best effort to thoroughly investigate into this matter of wiring, and to formulate rules and endeavor to practically carry out these rules. We shall look over the work of the State, and see that no work is done in the future that will not be strictly good electrical work. I only suggest that, and trust that when this committee is formed that it will carry out this work in such a manner as to make the State associations the mediums of communication between the National Electric Light Association and the people whom we are going to reach.

Mr. T. C. Smith: I merely wish to say a few words in reference to what Mr. Francisco has stated. I do not want him to suppose for one instant that we allow such a state of things to go along when we know them. The point I wanted to make was that the moral character of the wireman was only good when you knew it. We have had a good many bank presidents and cashiers who were very worthy, responsible and trusty men—until they went to Canada. And it is the same way with the wireman. He is all right until you catch him. And in order to catch a man's moral character you have got to have some way to defend yourself from that man after you have found him out. Now, as I say, our record in Philadelphia on the question of fires shows we have a good system of inspection there; that is, that the work has been well done. What I mean to say is, that where a wireman is at work on the sixth or seventh floor of a building and he has got one more joint to solder, it is an awful temptation to that man to twist a little copper wire, and let that slide in a place where it will never be opened. It is a good deal more of a stress on him, than comes upon a bank president to get out with $100,000 when he is $25,000 on the wrong side of his ledger. It is just that kind of a thing that we have to deal with. You take a building with 3,000 lights in it, and there are a good many of such, where every foot of wire is concealed. There you would have to put half a dozen inspectors on that one building, the whole time the work was being done, to know that every joint was soldered.

I am strongly in favor of a committee of this kind; but the point I want to make is, that we must look more to getting honest work than to laying down rules that can be evaded. You must make it a question of principle. I would like to see some rule or system devised which would be practicable, and leave the question of rules as much in the background as possible.

With regard to electric lighting stations, there is no necessity for concealing work of any kind. The rules that govern ordinary fire risks, I think, apply more to central stations than to any other building. I think there is infinitely more danger in the electric lighting stations from the boilers, engines and heating apparatus, than from the electric lighting wires, except, of course, the habit of throwing water on machinery that gets heated up, and, I guess, none of us would think of that, although we have heard of such things being done. (Applause.)

Mr. Cutter, of Chicago: About four years ago, I think, the New England Exchange was started. I like the idea of it. But we have got to wait four or five years for an exchange in the West, and then another lapse of time for one still further west and then finally join them in the national exchange. Can we not start the ball rolling to-day, and from the National Electric Light Association have a National Exchange that will establish the necessary organization? We do not want to wait longer in the West for the good results that you are getting in the East. We do not want to wait and go from one town to another for the good information that is to be had. We want, if possible, to start some sort of bureau, or exchange, or association, whatever you may call it, that will be a national affair, which will be the center of information for the best class of work and the best policy to be pursued in putting

(*Continued on page 10.*)

A Westinghouse Exhibition Plant.

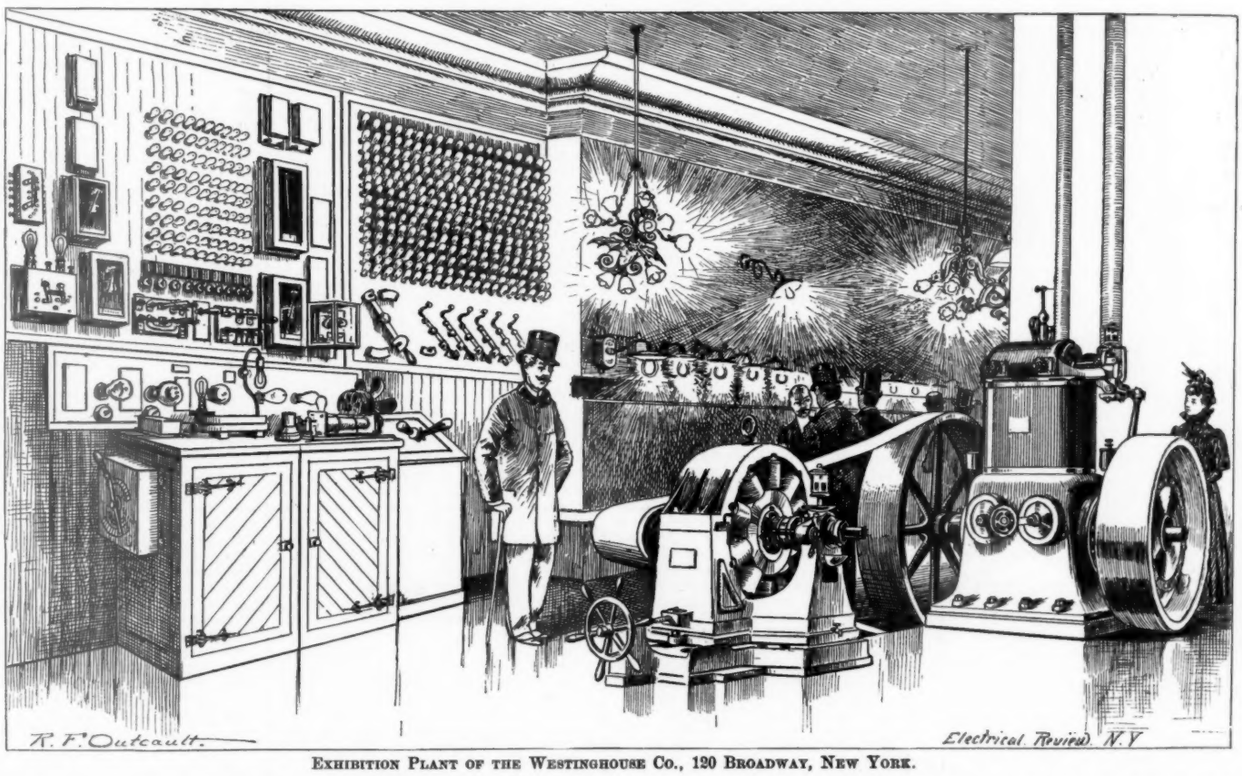
In the Equitable Building, this city, is a model central station plant, which the Westinghouse Electric Company have installed for exhibition purposes. The plant consists of a 500-light alternator and 50 horse-power Westinghouse high-speed compound engine. The dynamo generates a current at 1,000 volts, which is carried through heavy conductors to an apartment containing a set of transformers. Here it is reduced to 50 volts, which is the usual tension operated by this system in domestic lighting.

From the transformers the current passes to a very handsome and complete exhibition switchboard. Here are exhibited all the instruments and appliances used in central station work and house lighting. Standard voltmeters, ammeters and house meters are encased in glass, so that all the working parts may be easily seen. The house meter reads directly in ampere hours. A theatre regulator is shown which is used to reduce the candle-power of lamps used in theatre lighting. This regulator effects a great saving, owing to the fact that it reduces the voltage in the same proportion as the candle-power.

Street lights run in series, and varying from 10 candle-power to 150 candle-power, are seen along one wall.

A shunt coil is attached to each lamp, so proportioned that if a lamp should break, an equal counter E. M. F. is established, and the rest of the lamps on the circuit are not affected. Some well-arranged apparatus is used to illustrate very interesting experiments in induction.

Our artist has furnished us with the accompanying illustration, which gives a good general idea of this model plant.



EXHIBITION PLANT OF THE WESTINGHOUSE CO., 120 BROADWAY, NEW YORK.

—— The Asbury Park, N. J., gas and electric light companies have an understanding whereunder each refuses to supply light to parties that are in arrears on the books of either company. There is sound sense in a combination of that character.

—— Electric lighting is rapidly gaining favor in Butte, Montana. Scarcely a year ago, a company was organized in that place, a plant was established and one 750-light dynamo, Westinghouse alternating current system, installed. Since then, the demand upon the company has been so great that the capacity has been twice increased, and the central station has now three 750-light machines running at full load.

—— Des Moines capitalists have purchased the street railway plant at Springfield, Ill., and will adopt electricity as the motor power. The price paid was $125,000.

—— "Whipple's Reports," for February, show that there are 1,338 central electric light stations in the United States. This means that 73 stations were built during the month of January, an average of more than two a day.

—— Among the Pittsburgh electricians who boarded the "Electric Limited" at Pittsburgh for Kansas City, were: Morris Mead, superintendent of the Fire Alarm Telegraph; Mr. G. P. Shane, of the East End Electric Company; E. P. Acheson and S. A. Duncan, of the Allegheny Electric Light Company.

—— The Chicago board of public affairs has ordered all electric lighting companies to keep on hand constantly and ready for use a set of instruments to test the insulation, resistance and "ground," of all electric light wires, and to make weekly tests of its wires, and report the same to the city electrician. Also each light station must be furnished with a man that can be sent to every fire to cut wires when necessary.

—— The Plymouth, Mass., *Memorial*, in a recent issue, says: "This number of the *Memorial* is printed by electric power and folded by the same deft means. The engine that runs the press-room is in the station of the Plymouth Electric Light Company, on the corner of Leyden and Water streets, and the power comes over wires to a little motor about 18 inches high by two feet long and a foot wide. It runs smoothly, and while nominally of one and one-half horse-power, has developed two and three-quarters on occasions. There is no noise, no heat, no danger of explosion, fire risk at a minimum, and but little attendance needed."

—— The electric light is being largely used in Russia for illuminating saintly images in cathedrals. Thus, a magnificent figure of the Madonna, just placed in the Alexander Newsky Monastery, loaded with precious metals and gems of immense value, stands glitteringly in the focus of an electric beam, which is also the case with the "Kasan" Madonna in St. Petersburg. From near and afar thousands make pilgrimages to shrines. It has been decided to illuminate the ancient monastery of St. Ursula, at Olmutz, the first instance on record of its use exclusively in a monastery.

—— The Maverick Printing House, San Antonio, Texas, wants plant for 200 incandescent electric lights.

—— D. J. McRae, N. T. Skinner and B. F. Toole, have been appointed by the city of Cordele, Ga., to let contract for an incandescent electric light plant of 250 or 300 lights capacity.

—— Two rival companies, with electric lights side by side, are illuminating Gloversville, N. Y., in great shape. It is said that Gloversvillians sit up all night and sleep "day times," in order to get the full benefit of competition.

—— It is stated that Hollins & Company, of N.Y., through the sale of their controlling interest in the Municipal and United Electric Light Company of St. Louis, Mo., to Thalman & Company, also of N.Y., have brought about a complete separation of the gas and electric light interests in St. Louis. The price received was $600,000, and the deal was brought about by a disagreement in the syndicate as it formerly stood, and the unmaking of a policy on the part of the Hollins people that was so thoroughly opposed to the views of the others that a sale of one or the other interest was necessitated.

—— The central station electric light plant, Westinghouse alternating current system, at Fort Worth, Texas, has increased its capacity by the addition of a 750-light Westinghouse dynamo.

—— The residents of Great Head, Winthrop, Mass., will petition the selectmen for the insertion of an article in the next town warrant authorizing the placing of one arc and six incandescent lights on Cottage Hill.

—— "Rio Janeiro has been practically without electric light service," says a dispatch. Well, what of it? New York is practically without electric light service, but she manages to get on, and so do the burglars.

—— A comparison was recently made between a three horse-power electric motor and a four horse-power steam plant, and, including all expenses and excluding depreciation in apparatus, the cost of running the electric motor was 65 per cent. of what it was to run the steam plant, or, in other words, the saving in the use of the electric motor was 35 per cent. If the depreciation of apparatus for the time of trial was taken into consideration, it would have been in favor of the electric motor.

ELECTRIC LIGHT NEWS

—— Thomas & Gorman, Houston, Texas, are in the market for a 600 sixteen candle-power incandescent electric light plant.

—— Nashville, Tenn., is to have 50 miles of electric railway in operation by March 1st. They claim their system is second only to that of Boston.

—— Williamsport, Pa., has now an electric light plant of a capacity of 2,250 incandescent lamps. A new 750-light machine, Westinghouse alternating current system, has just been added.

—— Last week the town council of Elizabeth, Pa., contracted with the Fort Wayne Electric Company, for the furnishing of an electric plant for street lighting. It is expected that the streets will be lighted by the middle of March.

—— The cheapening of aluminium has led to a proposition to construct arc lamps of this material as preferable on account of lightness and qualities of resisting rust in comparison with iron, steel or brass, for outdoor use.

—— The electric light is becoming recognized as one of the best paying investments in the country. An electric lighting company in Pennsylvania, as an instance of good profits, has 40 arc lights and 1,000 incandescent, the latter having been lately increased by another 750. From the time it started, some three years ago, the company has paid an annual dividend of 17 per cent. to the shareholders.

—— Four of the finest electric street cars ever turned out at the Pullman factory have arrived in Joliet, Ill., and will be put on the west side lines, when the Joliet Electric Railway will be opened. These cars cost nearly $5,000 each. The interiors are upholstered in blue plush. They are lighted with incandescent lights, five of which are placed in the ceiling of each car. The cars are also fitted with small hard coal stoves, which can be removed during the summer months. The Joliet Street Railway Company is extending its lines in all parts of the city, and before the year is out will have 27 miles in operation, which will include an electric line between Joliet and Lockport.

NATIONAL ELECTRIC LIGHT ASS'N PROCEEDINGS.

(*Continued from page 8.*)

in our plants. And we want, if possible, to start from this Association and at this meeting. The sooner it is done the better, and immediate action is really essential. We want to start some movement that will establish an international affair.

Now, the New England Exchange has a sound policy, and it certainly seems to me that the ideas expressed by Mr. Francisco are excellent. We want this to be on a national and broad basis. I feel that if the wiremen of experience and the men who are working on important parts of construction are required to have a certificate from certain associations, and that when any wireman carrying such a certificate is placed on work, and is caught leaving an unsoldered joint, or covering a joint with tin-foil, that he must lose his certificate, that is something more than a moral powet. It is bread and butter for the next week or six months and he will not want to lose that certificate. We want this committee to be appointed on a basis, if possible, for prompt action, to organize the National Electric Light Exchange, if you want to call it so.

Mr. DeCamp: This is a subject, which as a central station man I am interested in; but it is one in which, in its various stages I have never seemed to take any part. I have watched very closely the action of this committee. It is a question that is always before us, and always a source of interest, but it has occurred to me that the committee is doing a great deal of unnecessary work; that is, it is work that will come before them in the future. As Mr. Cutter just remarked very pertinently, we do not want to wait four or five years to educate up a corps of competent construction men. There is one point in this that ought to be considered. The old axiom that no rule is without its exception is particularly true in this case. What is necessary to be done in one class of work is not so necessary to be done in another. Therefore, I think that the true way for getting at this, in the first place, is for this very admirable committee to devote their attention to the education of a corps of first-class inspectors and let them be taken from among the construction men. Now that works in this way. As long as you are engaged in any business which has the cupidity of the general public to deal with, you are going to be utterly unable to control it by any set of rules and regulations which you may lay down.

I suppose there are 50, maybe 100, so-called construction companies in the city of Philadelphia, to-day, and when we have occasion to discharge a workman, the chances are two to one that he will turn up in time as an electrical engineer, that is the class of men we have going around. Without a dollar of capital they will take a bid on a contract amounting to thousands of dollars, without the ability to carry it out, they manage in some way to get their goods; they will say they have such a contract, and want $400 or $500 worth of goods, and cannot pay for them until they finish the job, and when they get paid for it they will turn the money over. That is the only way they can do business. Now, if those men are watched and cannot get their work passed and they cannot pay their bills, their creditors will find that out as soon as anybody, and, in consequence, there will be no bills to pay, and they will gradually drop out of the field, and that plan will result in raising up a good corps of competent men. We have, in Philadelphia, one inspector who has done all the good work that has been done there up to this time. He works by no set rules. He goes by common sense, and that he is pretty near right I do not think requires any better proof than the fact of the little trouble we have had up to this time.

Mr. Perry, of Providence, R. I.: One very strong point has been brought out by Mr. Smith, and that is that the combined insurance interest, rich in its aggregate capital of hundreds of millions of dollars, this morning requires to have the hat passed around in this Convention to the tune of two cents to each lamp; that is a fact I am very glad to learn, and I shall take that back to my people with a great deal of satisfaction. You appointed a committee a year ago, of which I had the honor to be a member. Its report has been before you for discussion. We labored during the year and brought forth our report, and I am quite proud of it. If we go on formulating exchanges and working down through school districts and up through counties and states, and, finally, having this grand national insurance exchange, we shall have a grand institution; but what will become of the wiring and the general progress of the business while we are waiting for that concern? If, one year ago, when this committee was appointed by you, gentlemen of the Convention, you had simply recommended to the insurance companies that they send their inspectors to first-class reputable electrical engineers, and they had spent one week in connection with these gentlemen inspecting the installations in almost any town, at the end of that time, or a fortnight, they would have had sufficient knowledge to enable them to decently inspect almost any ordinary installation, and the whole thing would have been settled. That is where it has got to come finally, and we might just as well begin at that point as to spend a year getting there. There does not exist any necessity whatever for this grand and intricate organization, not the slightest. Why should our business be made a special exception from the ordinary routine by which such matters are accomplished? Why is it that we are compelled to pay 80 cents for an arc light, while a gas company is called on to pay only ten cents for a gas burner? There is not the slightest occasion for it, the thing cannot be gotten at. There is no mystery about the carrying capacity of a wire. For one cent you can buy a set of tables which any mechanical engineer will endorse as being perfectly safe to follow. It is a very simple matter, and it is a matter that rests entirely with the insurance company finally to say that they will or will not accept the installation. The question of poor workmanship will be settled by that, and that very definitely. When a man, or a construction company, has made a bid so low that it is necessary for him to put in inferior work to protect himself from absolute loss, and he does it, and the work has been rejected by the insurance inspector, and the man with whom he has contracted has thereby been given a just reason for refusing to pay the bill, and he is obliged to reconstruct it and make it meet the demands of safety; there will be no more trouble—he will not repeat the dose. He will not want his medicine but once, and all of them have got to take it about once. That is my experience with construction companies. I do not believe that there is the slightest necessity for going into this work at all. I think that this Convention should carry out to a great extent what we have recommended in the reports, that the insurance inspector who steps into a building and is competent to inspect everything in it except electric wires, should make himself competent to inspect that risk, and accept or reject it for cause. (Applause.)

Mr. Armstrong, of Camden, N. J.: I am very much pleased to hear from this member of the committee, and I trust he will pardon me if I say I like his remarks much better than I like his report. I do not believe that this Convention ought to employ an instructor of insurance inspectors. If we are to go into the business of employing schoolmasters for the populace, the first thing we will have to do is to employ a schoolmaster to go to Ohio. I picked up a paper here in town that a member of the legislature of that State had introduced a bill requiring all the dangerous electric wires to be buried throughout the whole State, and yet confessed in introducing the bill that he had never seen an electric light wire or an electric light, until four weeks ago, when he came to Columbus to be sworn in as a member of the legislature. (Laughter and applause.) I am sorry to have to admit it for the sake of the argument, and I trust it may not be held against me, but I have been a member of the State legislature and I know something of the wisdom and intelligence of State legislatures, and if it is proposed by the aggregation of the electric light companies of the United States to endeavor to instruct men in what they ought to know and what they give out that they are competent to do, we might as well surrender to them at once our whole plant and go out of the business.

Now, as to the recommendation of mutual insurance companies for electric lighting, I should be very sorry—there has been no reference made to that part of the report, and I should be very sorry to see this Convention, representing what it does, advocate the establishment of any company to manufacture wires or any company to manufacture dynamos, or any company to manufacture lamps or switches or anything of that sort, because as an electric light company officer, I want to get the best at the cheapest possible cost to my company, and I do not propose to start something myself, or in connection with other electric light men to beat down those prices. I do not propose to go into that business. One gentleman said that they had in their bureau of electrical control or whatever it was, the New England Electrical Association, I did not catch the name, such bright inspectors that they will never pass tin foil joints for solder. I did not suppose the pirates in the electrical wiring business would ever attempt to impose upon the people who know how to construct bass wood hams and wooden nutmegs (laughter and applause), but down our way, near Philadelphia, where we have been honest for more than 200 years, so that we have grown used to it (laughter); except for a few importations—I suppose they must have been importations—some of those New England inspectors who discover all these things—we have not had any accident by reason of defective wiring, I believe in the State of New Jersey of any moment that I can recollect, and I think none in Philadelphia, and it seems to me that the plan adopted there, whether the companies pay to induce the insurance companies to do it or not, is the best profitable one. I am not in favor nor will our company pay anything to the insurance inspector. The insurance inspectors do well. We will have nothing at all to do with the wiring; we do not want to have any responsibility for it, and will not, and for one I am not willing to endorse the organization of any electrical mutual insurance company. I vote for the remarks of the gentleman, but not for the report. (Applause.)

Mr. Perry, of Providence: It is quite obvious that I failed to make myself understood. My remark relating to insurance companies applies specifically to wiring done outside of our stations, but I do unreservedly want to put myself on record as endorsing the plan for a mutual insurance company for central stations.

Mr. Armstrong: I do not endorse that part of your remarks.

Mr. Perry: I have not asked the gentleman to do so. I was bound to give him the benefit of his own opinion, and let him give that to the audience, but I want to be distinctly understood as separating those two. I have my own views, as has the gentleman, about the advisability of central stations underwriting themselves. I am clearly of the view, after examining carefully into the workings of our New England manufacturers' insurance companies, that they can get insurance at a less rate than can be given them by the stock companies, or that they can procure from the stock companies, and, therefore, I want it distinctly understood that I endorse that part of the report.

Mr. Alexander: New Jersey, as you all know, is different from any other State in the country, and, therefore, the insurance men there may be entirely different from the insurance men in other States; but we in New England have had the experience that insurance men refuse to insure us. Now, what are you going to do about it? Are you going to go without insurance because you think they are wronging you? No, you would not do that. They do not know anything about electric light. I do not blame them. They think it is a dangerous element. They say we are writing an understood risk, and we ought not to be put to the expense of providing a competent authority to ascertain how to estimate this new risk. They talk very fairly about it, much more fairly than you believe. When they found the risk was a good one they reduced the rate, and, to-day, every building in Trenton that is lighted by electricity has a reduction of ten cents on its insurance rates. I believe the money paid out by the lighting companies is flowing back into their pockets, their business has increased rapidly on account of the good inspection, and the good we are trying to do now is to do away with that inspection, and it cannot be done away with anywhere because you will stumble over the same stone that we did. The companies will say we won't insure the building, we don't know anything about it. Now, we want their insurance inspectors informed on this subject and that can be done within six months or a year, and, therefore, the committee thought it would be better for the electric light companies to expend a small amount of money all over the country within the next year to provide the knowledge necessary for proper electric light inspection, and then reap the benefit that we are reaping now in New England.

S. E. Barton, of Boston: I am very glad that this Association has at last dropped the question of underground or overhead, or quibbling where we should hold our next Convention, and come down to the business of considering the subject before this committee, of which I have the honor of being a member, the question of harmonizing the insurance and electrical interest. I was very much interested in the remarks of the gentleman from New Jersey, but he evidently does not know what is going on in the United States. (Laughter.) I have been an insurance inspector myself for 15 years; I would not consider myself competent to be an inspector to-day: I would not consider myself an insurance inspector in all that term implies, if I did not consider myself competent to inspect an electrical installation as well as a gas installation, and that is the very point we are hammering at in the report of this committee. Now we have had the industry of electrical lighting going on in this country ten years or more, both incandescent and arc lighting, and to-day out of the nearly 1,000 that were employed by insurance companies over this country, I do not believe you will find two of them that pretend to know anything about the inspection of electrical apparatus. Why is it? Simply because they have let that alone as a subject too deep for them, and left it to work out its own salvation, and in working out its own salvation you have made the mistake here. The installations all over the country abound with errors that are incident to first construction, things that could not be avoided, but things that can be avoided and remedied in the future. Good inspection you say is what you want; you don't want to pay for it. You cannot get anything in this beloved country without you pay for it, or give an equivalent in some way. Now we have examined this matter, and we have taken the position that the man to inspect the insurance business is the insurance inspector who inspects every other hazard. He is not competent to do it to-day. You yourselves, who have been in the business all these years, know that he cannot be competent to do it without more instruction. He cannot qualify himself in a day; he cannot qualify himself in a year without an instructor. He is busy day in and day out, from one end of the year to the other, in his regular line of business. Now, we have taken the stand and hold to the proposition that it is wise for the electric lighting people—not this Association—but the electric lighting people throughout the country, to put their hands in their pockets and say to the insurance fraternity, we will provide the instructors not to instruct the people of the country and the legislators—that would be a hopeless task (laughter)—but to instruct the insurance inspectors in what is necessary to qualify them in their inspection. By the appointment of a sufficient number of instructors you could furnish object lessons to these insurance inspectors, show them what is necessary when they have to discriminate between good and bad work by showing the good and bad to them, and have the understanding that we do this, perhaps, as a piece of missionary, call it what you please. This committee was appointed not to point out what ought to be done, or what are the rights of the electrical people and what are the duties of the insurance people, but its very name says what it is for, it is to harmonize the interests of the insurance and the electric lighting people, and that is the way we believe they can be harmonized, by conceding on the part of the electric lighting people in the first place so many dollars and cents to be paid out by you people, and that to end at a given time, give them fair notice in the beginning that they are expected at the end of that time to have their men qualified and competent to do it, and take my word for it, they will be so, and then you have got your inspectors, you have not got to create them, they are already created, and they have been given the necessary instructions to do just exactly what wants to be done, and what you are after. Now, in Philadelphia, as Mr. Smith says, we are doing a grand work, but they are doing simply what we have been doing in New England for years, and you people are reaping the benefits of it. You are getting lower rates of insurance on properties lighted exclusively by electric lights, than by any other class, and the insurance side is losing nothing by it, we are making money. From my standpoint as an insurance man, I wish every other kind of illumination was driven out, and that electric lighting was the only thing on, we would have a great many less fires. Those, Mr. President, are my ideas with reference to the question of inspection, and to the recommendation made by the committee. I believe it is something that ought to be done, and the voice of this Convention ought to be unanimously for it, and I believe I can safely speak for the insurance companies and say that they will heartily co-operate with anything in that direction. Now, then, I want to say a few words in relation to the project of an electrical mutual insurance company. I have had it in my mind for some time, if you will call to your minds one year ago at Chicago, in speaking upon electrical lighting stations as fire hazards, I said then that I believed the establishment ultimately of an electrical mutual insurance company, or something of that sort, would be the only solution to the question of insurance on central stations. I believe it more fully to-day, and I also said at that time, that I believed that those few companies who are doing business in insuring electric lighting stations to-day, even in their deplorable condition, are making money. Now I know they are. Since this prospectus has gone out no less than eight of the large and prominent English and American stock companies have asked to have a hand in it, just what we want, something that shall prepare the stations to make the good risks, and conduct them so that they will give us a part of the insurance, and that is the plan that is contemplated by the mutual company; it is not intended to antagonize the stock interest at all, but on the contrary to take in with it all those who want to come, and eight of them have manifested that desire, and the largest American company, not to call any name, stated to us recently that it has been insuring electric light plants, central stations, for several years at nothing less than two per cent. They have made that the minimum rate and they have taken almost anything at two per cent., and have made money out of it; they have kept it to themselves; they now come forward and say we do not want to lose that class of business, but we want to come into this plan and take our share of it. One of the smallest companies in the country, a company which started a few years ago, told me that it took electric lighting stations simply because they wanted business and could not get anything else.

and within two weeks they have told me that their premiums in two years were over $60,000 and their losses less than $300 on electric lighting central stations. (Applause.) They want a hand in it; they have found that it was a good business, not because their wishes taught them in the beginning, but because their necessities taught them. I think that you, Mr. President, advanced the idea to me that you thought your idea of harmonizing these interests did not coincide with the formation of an electric mutual insurance company, feeling that that would perhaps antagonize the stock interests. That is not so, in the first place, and in the second place even if it were so, I would take the mutual insurance company, because it is undignified in the Electric Light Association to throw to the stock companies their insurance business as a sop to keep them satisfied. It is not necessary in the first place.

I want to say a few words in relation to the examination and licensing of men employed in electric lighting installations, the work being done by the New England Electric Exchange. I cannot agree with my friend, Mr. Smith, that that method has not given a guarantee of the character of the man. On the other hand, that is one of the important features of it. It examines him technically first; it then considers his moral aspect, and not a license is issued until it has been laid before and countersigned by the man who knows him personally and knows his habits and everything pertaining to him better than anybody else, and that is the inspector of the New England Insurance Exchange. Every license has to go before him and receive his countersign, and thereby the exchange has the guarantee that that man is all right in every respect, and I know it is so, because I know that more than one man has not received a license simply because he did not meet the requirements in that one particular phase while he did meet them in other points. Now, Mr. Smith says we do not need rules for the installation of electric lighting apparatus. I can hardly agree with him there. I myself feel that the rules that we have in New England are on the wrong tack, that if these rules were turned around, and instead of saying what should be done in the line of safety, they said what should not be done, it would be more in accordance with my ideas. But we could not start that way. We did know in the beginning what should not be done. We knew in a crude way what should be done; we have gone on and from time to time, as experience has brought out things, we have added to those rules until they are complicated and cover a great deal, not of ground, but of paper, and, I believe, as Mr. Cutter said in the beginning, that it would be to the advantage of the electric lighting industry all over the country, if some sort of committee could be formed to draft a set of rules of some sort. It could be made a standing committee, whose duty it should be to consider and revise the rules from time to time, then we would have some rules that would obtain not only in New England, but in California, and even in Chicago; that is exactly what we ought to have. When we first started the method of examination in New England we had a different inspector for each locality, one at Boston, and one at Portland, Me.; New Haven; Springfield, Mass.; and at Providence. What was the result? A party installing a plant in Maine was subjected to one set of rules; when he went to New Haven or Providence or anywhere else, he had to conform to a different set of rules, and that is the condition of things all over the country to-day. We ought to have some general rules, so that the party installing in New England would meet the same rules when he went to any other part of the country. I would like to see a committee appointed for that purpose, and I would like to have a good part of that committee made up of insurance men, who are the only men who can enforce any rules you make. You must work together with them. I would have a certain number of practical electrical experts on the committee, and those men could be selected, one or two by this Association, and one or two by your sister Edison Association, and let the committee be large enough to cover the whole country and small enough so as not to be cumbersome, and let it govern the question of rules, and let those rules be condensed and solidified and brought right down to what is useful for safety, and then have the rules so framed that the insurance inspector who can tell you all about everything except electricity, can understand them, then you have men spread all over the country to see that those rules are enforced, and before you know it you will not need any further inspection. You will have then a great governing committee who will stand behind this national committee on rules, and amend them from time to time as need be, and the committee will be useful in many ways. Going back to the subject of mutual insurance, I want to impress upon you the importance of the fact that the inspectors of your mutual insurance company will be excellently qualified to give valuable ideas to the insurance companies. The company will break down all the barriers of prejudice, it will show to the country that you are not afraid to insure your own plants, that they are not those terribly hazardous fire generating establishments that they are commonly understood to be. I hope that the recommendations of the committee will prevail.

President Weeks: Knowing the good work done by the New England Exchange, and fully appreciating the importance of the work of this committee for the electrical interests of the country, the Chair has allowed rather a wide latitude to this discussion. We have with us Captain Brophy, of Boston, of whom we have all heard much.

Captain Brophy: I am pleased, as one who has no pecuniary interest in any electric lighting company, to have the privilege of saying a few words to this Convention. I began, as you know, with the New England Exchange four years ago to supervise and examine the work done by electrical people. I am happy to say that from the start I had the hearty co-operation of every man engaged in that business. We have done, I think, a work that has been of exceeding great value to the electric light fraternity in New England. I think any one here who represents New England will bear me out in making that statement. The insurance people were entirely ignorant of this new element that was introduced into buildings that they insured, and naturally were wary of it; they felt that it was no part of their duty to maintain this inspection at their expense, as all of the risks at that time were insured and rated before electric light was introduced, consequently they made arrangements with the electric light manufacturing company to bear a portion and a large portion of that expense. They did so reluctantly at first, they did so with a great deal of doubt. To-day more than one of them have testified to me that the expenditure thus made has been returned ten, yes, a hundred fold. Our losses from fire have been so insignificant that they are hardly worth noting so far as the loss to insurance companies was concerned. I wish to state here emphatically that the report made by the worthy fire marshal of the city of Boston to the board of aldermen that in his belief the disastrous fire of Thanksgiving day was due to electric wires, was made without due deliberation and with a wonderful lack of necessary information. Any one who knows anything about the condition of affairs there must know that that was not the cause of that fire. I certainly do, and if I had any respect for the electrical knowledge of the worthy fire marshal of the city of Boston previous to his report, I have since lost it. (Laughter.) Now, something as to the work of the New England Electric Exchange. I was one of the promoters of that institution, I did all I could to force it into existence. Some vigorus English I made use of at a meeting brought forth that child. Now, as to Mr. Smith's objection that a technical examination will not reach the moral character of the man examined, I will say that I know every man engaged in the electric light construction work in New England. They are all my friends, and when I find a man whose moral character or whose habits unfit him to be in a responsible position, I do not hesitate to tell him so in plain and vigorous English if necessary, and withhold my signature to his certificate, no matter how great a knowledge he posesses or how expert a workman he may be, so that we have no trouble from that source. We have had since the organization of that exchange, a set of men employed in construction work, that in point of intelligence and in knowledge of their business, cannot be excelled in any part of this country. The time is fast approaching when the duties of the inspector must cease in New England, unless he wishes to become a pensioner upon the bounty of the electric light fraternity, and he has not reached that age as yet. This is owing to the hearty co-operation of the men engaged in the electric lighting business in New England. As I stated to our executive board only a day or two before I came here, the work is now done so much better than when we began, that in many cases the duty of the inspector is simply a matter of routine; we have arrived at that happy stage by a rigorous inspection, by rejecting every piece of poor work that we could find, by impressing on the minds of those engaged in constructing work, the futility of attempting to palm off anything that was not first-class, and in all this work we have not been obstructed in the least by the men most interested—the electric light companies and construction companies. In regard to these men who spring up in every village, who have strung a telephone wire, or a bell wire, or a gas lighting wire, and attempt to enter this business, we have a little rule that puts a stop to that at once. We issue a circular, giving the names of men authorized by the New England Insurance Exchange to do construction work. A man who wishes to get on that list must satisfy us beyond a doubt of his competency and his responsibility, before his name gets on the list, and now a party whose name is not on that circular has rather a poor chance to get rich in the construction business. There is a prejudice in the minds of the people that never should exist. Many people believe that death is present in every foot of electric wire. Many people believe that when it is introduced into their buildings their property is liable at any time to be destroyed by fire. There is no just reason why this should be believed. The men engaged in the electric lighting business in New England, are as honest and as unwilling to hazard the lives and property of any of their customers as they would be to imperil their own, and the feeling that has been engendered in the minds of the public has been created largely by the sensational press of this country, and is one that never should have existed, and is a gross injustice to the men engaged in the business of furnishing the best light, excepting sunlight, that ever glimmered on the face of this earth. It is unjust that they should be subjected to such an outrageous raid on their business by the sensational press of this country, by men who write articles, but do not know the technical difference between a wheelbarrow and a dynamo. (Laughter.)

Mr. Smith, of Philadelphia: I am afraid I have not made myself as clearly understood as I should wish. I am not opposed to rules. The only objection I make to the rules is that they are too complicated. What we want is a few general rules of what should not be, rather than a great many small rules of what should be done.

In regard to the other point mentioned by Mr Brophy, I am heartily in favor of having the insurance man the inspector.

Mr. Williams, of Ohio: I happen to be interested in several insurance companies who in the past few years have had a large number of central stations on their books, and we endeavor to get them periodically inspected. We have found ourselves confronted with very many difficulties. We have found that while our directors in several companies were practical business men and manufacturers earnestly inquiring into the advantages and disadvantages of electric light, yet the business itself has developed so rapidly that it has been almost impossible for us as a small combination of companies, to keep pace with that development. I believe you will readily recognize the condition. Your committee to harmonize electrical interests with insurance interests is well named. I do not know whether it will ever be accomplished, perhaps it may be, certainly at present those interests are very directly opposed. As one gentleman has remarked, you ask for insurance on a station and the company simply says the rate is so much, without entering into any calculation at all. That is simply their position. If you don't like it, you can go without insurance. On the other hand, our friends from the New England States have advanced very many strong arguments in favor of the reduction of rates. The question of the rate on the central station has not, it appears to me, been very much touched upon. There is this consideration that I would like to present. We are not altogether dependent in this country on the stock companies. I am glad to see that our friends have presented proposals for a mutual company. I hope it will crystallize into a good, solid, substantial company. The plans and purposes are in the direction of harmonizing those interests.

I take it that the question narrows itself down to the insuring of central stations and power stations, and if that system of inspection is to be adopted, it seems to me the only reasonable way in which it can be done will be at the expense of the companies. The central station should be willing to pay a fair rate at the outset, and let the insurance company get its statistics from the inspectors and ascertain the exact rate at which the insurance can be carried. That is the plan that has been followed successfully in the East, and I think it can be followed in the West. Then you avoid this necessity of educating inspectors. It seems to me if this Association were to undertake that, it would be a very hard question. Who is to educate your first inspector and your sub-inspector? You have a mass of work on your hands that would be interminable, and certainly would not tend to harmonize the insurance and the electrical interests.

As to rules that have been spoken of, we are in favor of rules. We want rules. Nothing can work without rules, but they should be as simple as possible and be reduced to a clearly understood basis. Those rules could be formulated in this Association from that committee that should be composed of insurance and electrical men, and then every State association could adopt them and there would be no difficulty in arriving at a beneficial result.

On motion of Mr. M. D. Law, of Philadelphia, the report was adopted.

Mr. Geo. E. Palmer: I have listened with a great deal of interest to the discussion this morning, but it has occurred to me that the National Electric Light Association are making the same mistake now that was formerly made in the American Society of Mechanical Engineers, and other societies to which I have belonged, to wit, an unlimited discussion of papers. It was found in those societies that in order to get through with the business in reasonable time and not tire everybody out, that remarks on papers, reports, etc., should be confined to five minutes by each speaker, so that all persons may be heard, and the business of the Association rapidly pushed through, and the business of the Convention not delayed so that it could not be closed at the proper time. If it is proper for me now, I wish to make that motion.

The question on Mr. Palmer's motion to restrict remarks in discussion to five minutes to each person, was carried.

Secretary Garratt read the paper prepared by C. J. H. Woodbury, of Boston, which appears on page 5.

Mr. Perry, of Providence, R. I.: It seems to me that this paper might be more properly entitled "Permanent Construction of Central Stations." It is about time that we began to look about and consider what size central stations we shall have and where we shall have and where we shall locate them with a view to permanently develop the business of producing electric currents to be distributed for whatever purposes used throughout the communities where we are severally interested in this business, and it is possibly on that point alone that I shall offer a single suggestion.

I think I speak advisedly when I say that almost every central station man throughout the country has set down, finding his station too small, enlarged it to meet the requirements of all time, got it not quite completed, and found it was still too small. (Laughter.) I think we have rebuilt three times, but the last time we determined to settle that matter for a considerable period, so we bought a plot of ground 200x300, covered it about half, which with the ordinary 50 light machine would develop the dynamo room, which is 60x200, so that we would easily handle the 4,000 lights in our city. We find now we have got to just duplicate that.

I think there are some general lines on which it is safe for us to proceed. It is a very important point if possible to so locate your central station that if you are inland near a railroad, you can run a track in and switch your coal in right by the car, or if coal transportation can be reached by water, you can locate as near the water as possible and get the advantages of water transportation.

Now, a word in regard to boilers. Locate your boiler to develop this whole plot of land. Make arrangements with your engine for that purpose. Then put in your first ones and follow that out on these general lines. Now, the question as to engines is a very important one, and as we know is a very much discussed one. My idea about that is, that when you have determined by that rule of taking your gas outputs, provided, of course, that your community is using gas extensively, you should take that gas output and multiply it twice or three times, as you have the courage to do, and then make your preparations to supply that amount of electric current and divide that into about ten units. Those ten engines are equally adapted to delivering the power on jack-shafts and belting up over head, which I believe is the best way. By and by, when you get along with your unit as a thousand horse-power engine, you can drop your jack-shaft and belt right up to the engine.

One point I wanted to emphasize was this. When you set about constructing your station it should be of a permanent character; and there should be made very large and liberal arrangements for the growth of your business. If that is neglected, there will be the universal inconvenience which has already been suffered from starting up in a hen roost (laughter), or under a shed outside. I believe the loss of money in this direction is greater than in any other in central station experience. The fact is, the day has gone by for that sort of thing, entirely. The man who had a common wood-saw would carefully grease it and wipe it and hang it up on a nail in a dry place, but he didn't hesitate to pay four, five or six thousand dollars for an incandescent light plant, and then stick the whole thing out in a shed almost without cover from the weather. The thing has been so utterly absurd that it is hardly necessary to discuss it.

The strong point I wish to bring out is the providing of ample space or ground. Buy it and own it. It is what you want for future growth and development. That is certainly a pertinent lesson that has been taught us by the universal experience of all men engaged in central station construction. (Applause.)

Mr. M. J. Francisco, of Rutland, Vt.: I would like to ask the speaker if he recommends independent condensers? Has Mr. Perry had any experience in running an independent condenser?

Mr. Perry: We had designed for our station an independent condenser, operated by an independent engine, and it had some unusual features. It is the first cut-off cylinder that was ever put on a condenser that I know of. We have been operating with that since about the middle of December, and it has been very satisfactory. We have a guarantee as to the steam or water consumed in developing a certain amount of power, so

that it is to be brought down on to the same level of economy as the main engine. The condenser which we are operating is a condenser designed to handle easily 2,000 horse-power. Our first engine is in, and we have worked it up to 750 horse-power, and have never had a minute's uneasiness. It has never been shut down for an instant. It has operated so satisfactorily that we have now contracted with the builders, and they are at present constructing for us another engine of the same stroke, the same diameter of fly-wheel, and intended to drive on the same shafting up to 1,500 horse-power.

President Weeks: As the next paper is upon a kindred topic, the steam engine, before disposing of this, before closing the discussion, the general discussion upon this topic, we will hear from Mr. Fred. E. Sickles, of Kansas City, upon "The Steam Engine."

Mr. Sickles then addressed the Convention on the subject of the steam engine. His paper will appear in our next edition.

Convention then adjourned to meet on Thursday morning at 9.30 A. M.

THIRD DAY'S PROCEEDINGS—FEBRUARY 13.

MORNING SESSION.

Having moved back to the Coates Opera House, after its one day's session at Music Hall, the Convention was called to order at 9.30 o'clock A. M., President Weeks in the chair.

President Weeks announced that the badge of the organization entitled members to free passage on the lines of the Inter-State Rapid Transit Company and the Metropolitan Street Railway Company.

Mr. Babcock's paper "On the Economical Generation of Steam for Light Stations," was read by Mr. Palmer, and will appear in our next edition.

Mr. Sickles: I would say, in regard to Mr. Babcock's paper on boilers, which has just been read, that I agree with it in the main; but I object to one statement, and that is the statement that stayed services are unsafe. Now, this is a question of fact. We have tried boilers long enough to know whether stayed are unsafe; and we have in the world thousands of locomotives running into stations every minute with a large amount of stayed service in them for 50 years, and not one of all these have ever failed. It is not true that stayed services are unsafe. They may be made unsafe, but they are not necessarily unsafe; and, therefore, I shall have to object to that part of the statement. But the general scope of the statement I think I can agree with. The idea that you must put a very rapid current through a tube and subject it to the passage of the heated gases at right angles to this tube is correct.

It is important to so arrange the boiler that it can be forced in an emergency, and not be obliged to carry a large number of boilers that would be available, perhaps, only an hour in 24. It is better to sacrifice a little economy rather than have too large an amount of money lying idle, as would be the case in having too large an amount of boiler surface.

Mr. T. C. Smith: With regard to the question of being able to force your boilers, that proposition has another side to it beyond that of the mere question of having money lying idle. There are very few central stations doing incandescent work, but in which the bulk of the load does not come within two or three hours in the day, and the load at that time will be enormously in excess of the average load. If you can force your boilers during these two or three hours, by keeping the fires clean, and being ready for the heavy load when it comes, you not only save the cost of a surplus boiler plant, but you save very largely in your fuel consumption. I know of a station where the fuel consumption is increased 50 per cent. by the necessity of having to fire up the second boiler for the two or three heavy hours duty between four and eight o'clock. The banking of your fires during the day must be done, or you have to make a fresh fire. In order to carry a banked fire, a banked fire takes as much coal—a good deal more coal than would be sufficient to run that heavy load, if you are able to force your boiler a little more, and burn that coal under the boiler that was being forced. For that reason, I think that a large source of economy will be found in central stations by putting in a forced draft apparatus, more than in increasing the boiler capacity. I know there is a strong prejudice against forcing boilers on the score of danger from it, but I do not think that any electric light station should be run by any man that cannot be trusted to force a boiler without endangering it. I do not mean to force a boiler, of course, beyond a reasonable degree. With regard to the remarks on flat stage surface, I have only one thing to say. I was brought up on the big shell boiler, boilers running anywhere from six to seven feet in diameter, and one or two big flues through them; and there are several points in favor of that boiler that ought not to be overlooked, such as the easy cleaning and examination.

Mr. C. J. Field, of Brooklyn: I do not think we ought to pass over Mr. Woodbury's paper, submitted yesterday, without looking at it a little more carefully. We all know what Mr. Woodbury has done in New England mill construction. New England mill construction, in the last few years, has done more to bring up the standard of buildings of that class, and make them safer against fire, than any other class of construction in the country. And when we see that these principles there can be applied to small station construction, I think these points are such as the electric light company ought to know and give attention to. When we can go into small towns and stations with hollow walls overhead, and with all those things that go to make bad construction, and at very little expense make them as safe as fire-proof buildings almost, as far as fire is concerned, I think it is a matter that it will be profitable for us to consider and carry out.

Mr. M. D. Law, of Philadelphia: In the management of electric light stations, there is one point that has not been specified by Mr. Woodbury, which is very important as regards safety against fire. I have discovered the same trouble in Kansas City in the plants that are located here, especially in some of the private installations, and that is the packing of waste underneath the machine for the absorption of oil. It, perhaps, looks to you like a little matter, but in nearly every case, especially where high tension currents are employed, you have to use a wooden floor for the measure of safety. By packing waste under the machine you place a tinder-box there. It may run for years without any trouble whatever, but in the case of an armature's burning out, and armatures will burn out and throw fire for a long distance, this ignites at once, and you have a nice little fire to take care of. I speak of this because I had the same trouble several years ago in packing waste under a machine, an armature burning out and dropping some melted copper on the waste. The consequence was that all four field magnets had to be rewound on the outside, and we came very near having a nice little fire in our station. It was only having water buckets in close proximity to the machine, and rubber blankets that saved us. The rubber blankets I think did more towards putting out that fire than the water buckets. They were immediately grabbed up and thrown over the fire, and smothered it. I saw that Mr. Woodbury had not spoken of that matter, and it is an extremely important one. Mr. Woodbury has given us an explanation of a baby station. It is of hardly sufficient size for even a country town. In our experience, it is far better to build a two-story station, having your dynamos on the upper floor, your roof trussed in order that there shall be no posts or wires projecting up from dynamos to it, to interfere with the rapid moving of machines from one portion of the room to another, or the changing of armatures; as the continuity of your lights is the criterion of your success, you want to have your machines in such shape that an armature can be rapidly changed, and also that if the machine flashes, that the dynamo man can get there quickly, and that that machine may not flash the second time. Flashes mean rebates, and they are very expensive things to have.

Mr. S. E. Barton: In reply to Mr. Law, I think the reason why Mr. Woodbury has not referred to waste and things of that sort is because he thought that was beyond the scope or intention of his paper. His purpose was to describe the method of the true construction of the station, and not the methods to be employed in the care of the station afterwards. The question as to the danger of waste is purely a question of care, and gross carelessness or negligence may occur in the most modern constructed station as well as in the poorest constructed one.

When a station is constructed as Mr. Woodbury designs, it is slow burning any way. There is nothing for the fire to feed upon to gain rapid headway. The keeping of a station clean by washing the floors in some instances cannot be well and safely done with the present practice that prevails almost universally of running wires from dynamos down through the floor, for no purpose that I can conceive of except for the purpose of bringing them up from the floor again. I know of no reason why wires cannot go direct from the dynamo overhead in plain sight.

Mr. J. A. Seely: I would like to ask for information in relation to the building of floors. I have not heard any opinion expressed in relation to concrete floors. I would like to know if there is any objection to concrete and what has been the previous experience in that line.

M. J. Francisco, of Rutland, Vt.: If the gentleman will build a concrete floor and put his dynamo on it, and then try to handle the floor, he will get an illustration of what it is.

Mr. C. J. Field, of Brooklyn, then read a paper on "Development of Generating Stations for Incandescent Light and Power," which will appear in the next edition of the REVIEW.

Mr. DeCamp: I want to ask Mr. Field one question. I think in the early part of his paper the statement was made that the fixed expenses of the station was 75 per cent., and variable expenses 25 per cent. May I ask just what is meant by "variable expenses."

Mr. Field: Variable expenses are coal, lamp renewals, any increase in oil, and any addition to the labor account.

Mr. DeCamp: I presumed that was about it. Do you not keep extra pay rolls?

Mr. Field: No, sir. If we double our out-put, of course, our pay roll would increase to a certain extent.

Mr. DeCamp: My understanding of it, as you stated it there was in making up your summary, that your fixed expenses were 75 per cent. and the variable expenses 25 per cent.; and I inferred that was the actual fact. But there are what you term "variable expenses." Of course there is an average on which you made them up.

Mr. Field: These are based on 5,000 lights connected, and are based on actual facts. But the labor account for that number of lights connected, go into the fixed expenses. There is no valuable labor account, or extra labor, or anything of that sort, if that is what you refer to. This is for 5,000 lights connected. We have 100 per cent. operating expenses, of which 75 per cent. is independent of the number of lights connected; and if we doubled that number of lights connected, making it 10,000, our operating expenses will increase approximately 25 per cent. I recognize the fact, that estimates will vary in different stations, and to a different extent, according to their management and the way of working the operating force, etc., but it is about the figure in stations of that class.

Mr. DeCamp: I believe it is a theory (the increase of expenses), the ratio of increase to expenses is not properly appreciated. I believe it is very much greater—the ratio of increase to the ratio of expense is very much greater than is generally supposed to be. I have had a little experience in that direction, and I draw my conclusion from that and from considerable observation.

Mr. Field: I have not drawn these conclusions from one station, or from theory. They are drawn from fact as they are represented, and facts as represented in a large number of other stations of the same class, based on actual results in them, in different lights, at different times in their history.

Mr. A. P. Seymour, of Syracuse: Mr. Field has covered the ground very thoroughly, I think. But, it seems to me, there is one rule that can be applied to all localities. That is to say, in different localities you cannot apply any specifie rules, but there is the rule of using common sense, which can be applied every where and under all conditions, to great advantage. Another rule that can be applied every where is to do your work well.

Mr. J. F. Munsie: I desire to ask Mr. Field a question. You claim that the Edison is the best for distribution?

Mr. Field: I said for certain classes of work.

Mr. Munsie: Well, for electric lighting distribution?

Mr. Field: On low tension circuits.

Mr. Munsie: Individual circuit distribution? We have an exhibition here, which I think will clear up that assertion, without any more talk on it and one which I think all the members of the Association should examine.

Mr. Field: I have endeavored to give actual results, obtained from data, and results that I know are being obtained, and have been obtained. I know stations which I could give by name, where results are actually obtained, and where many of them have gone on the false idea that has been prevalent for several years, working just on the border land, having a good business, had not had the capacity to increase their business, or, lacking management, where no increase of plant has been made, but where an increase of plant would have been followed by good results to the station, and directors and stockholders. It is a proposition that you have got to meet.

Mr. Alexander: I think Mr. DeCamp and Mr. Field are right in their respective ways. Mr. DeCamp's experience has been with arc lights, where an increased business does reach a largely increased cost of labor in them for repairing circuits, supplying carbons, etc., and things that Mr. Field does not have in the incandescent lamps. The operating expenses of a station need not be increased very much, or so much in the incandescent. I want to ask Mr. Field one question. He made one remark in his paper, that within five months he had but one cross that they blew out, by which I suppose he meant that they burned it out. I want to ask this question, first, whether the third wire was grounded, and, secondly, whether he considers it safe to blow on a cross? I think if you do that you increase the danger of electric lighting considerably.

Mr. Field: That is treading a ground that I do not think has been thoroughly settled in the question of grounding the neutral wire on a three-wire system. It is a question that has not yet arrived at a solution, yet it is a thing that has to be left to the individual judgment of each manager. It varies in different systems. You strike some old systems where they practically have not grounded their neutral wire owing to defects in their underground system. They have done that to avoid a cross between their outside two wires, as by grounding their neutral one, to come in between their positive and negative—when the "ground" wire attempted to come in between the positive and the negative, they would blow that off.

In answer to the question Mr. Alexander asked, about blowing off the ground, I think it is like this, when you get a heavy cross on your underground system, what are you going to do? It is going to play old Harry, and you have got to shut down or blow it off; that is all there is to it. I do not think you are taking any chances, that is, any great chances. I have seen a good many blown off, and I never knew them to give any trouble. They will make the lights shake for a few minutes, and then you will go on serving your customers, just as you did before, and take your time to hunt it up.

Mr. T. Carpenter Smith, of Philadelphia, addressed the Convention on the subject of central station accounts, etc., which will appear in our next issue.

Secretary Garratt: The St. Louis Exposition Company has requested the American Institute of Electrical Engineers, the National Electric Light Association, and the electrical fraternity at large, to each appoint one of a committee of three; that is, our Association will appoint one of the committee, the American Institute will appoint another, and another will be chosen at large by correspondence. It now devolves upon this Association to name its member, Mr. Carl Hering having been appointed by the Engineers.

Mr. Perry: I nominate Edwin R. Weeks, of Kansas City, as the representative in behalf of the National Electric Light Association. Carried.

Adjourned to 2.30 P. M.

THURSDAY AFTERNOON.

The Convention assembled at 2.45 o'clock, and President Weeks announced that Mr. DeCamp would address the delegates on "The Cost of the Products of Central Stations." This address with the discussion will be published later. Messrs. M. J. Francisco, C. J. Field, H. Ward Leonard, T. Carpenter Smith, F. A. Wyman, J. E. Lockwood.

A telegram was read by Mr. Geo. M. Phelps, as follows:

Bill for restriction of voltage in Virginia has been reported adversely by unanimous vote of Senate committee, after two days' argument. It was supported by Edison in person and the electrical executioner; opposed by Westinghouse representatives aided most efficiently by local companies.

(Signed.) R. W. POPE.

The dispatch was received with applause and filed.

Mr. M. D. Law's paper on "Nine Years with the Arc Lamp," was presented, and Col. C. M. Ransom read Mr. E. F. Peck's paper on "Arc Light Carbons."

Mr. DeCamp asked if any one had ever seen the arc lamp at the Centennial, in 1876, alluded to in Mr. Peck's paper.

Mr. Garratt said he saw one in Boston in 1865—an arc lamp run by clock-work.

Mr. J. E. Lockwood said that Mr. Frank B. Rae, of Detroit, could tell about the Centennial lamp.

Mr. F. S. Terry said he had seen the arc lamp at the Centennial. (Applause.)

Prof. Elihu Thomson's paper was then presented in printed form, and Mr. J. E. Lockwood opened the discussion.

Capt. Brophy paid his respects to the Board of Electrical Control, of New York city.

The report of the Committee on Electrical Data, Mr. A. R. Foote, chairman, was read by the secretary.

Mr. DeCamp moved that the report be accepted and that the committee be continued. Carried.

Mr. DeCamp offered the following resolution which was adopted:

Whereas, The superintendent of the United States Census has appointed a special agent for the investigation of manufacturers of electrical apparatus and supplies and their uses; and,

Whereas, This is the first official investigation that has ever been made of this subject in this or any other country; and,

Whereas, It is the opinion of this Association that such investigation will be of the very highest value as a means of furnishing the public with information that it can accept as being reliable, impartial and authoritative, and for that reason will be of great value to those interested in the electrical industry; and,

Whereas, This association, in behalf of the electrical industry of the United States, desires this investigation to be thorough and complete in every detail, and is aware that such an investigation could not have been fully authorized and provided for, on account of the newness of the industry, when the law providing for the census of 1890 was enacted:

Be it Resolved, by the National Electric Light Association in Convention Assembled:

First, That it respectfully petitions the Senate and House of Representatives of the United States Congress, to authorize and direct the superintendent of census to collect the following data in relation to the electrical industry, in addition to the general statistics of manufacturers already provided for by law.

(a) Details pertaining to underground and aerial construction, underground and aerial currents, the

character and voltage of all currents and their uses. Lamps in use, arc and incandescent, and how wired for residence, commercial and municipal service, motors in use for stationary service and motor cars, income and expenses, etc.

(b) An inqury, through sources independent of those interested in the industry, as to the casualties resulting from the use of electric currents, both as to fire and personal injuries. This investigation to be made in all cities of 10,000 population and over. The information to be obtained from underwriters, the records of fire departments, coroners' statistics, health boards or commissioners, or from whatever source of information that may exist in any city. The investigation to make a comparative statement between the casualties resulting from the use of electric currents and the use of other agents employed for similar purposes.

Second, That we hereby petition that an appropriation of not exceeding $50,000 be made for the purpose of this investigation.

Third, That the National Electric Light Association hereby tenders its thanks to the Hon. Robert P. Porter, superintendent of census, for the recognition he has given to the importance of and wonderful progress made by the electrical industry, by the appointment of a special agent for its investigation, and we hereby pledge our cordial co-operation with the census office in its efforts to make the investigation thorough, reliable and complete, in every detail.

Fourth, That a copy of this preamble and resolutions be properly engrossed, officially signed by the president and secretary of the Association, and transmitted to the chairman of the Committee on Census of the Senate and of the House of Representatives, and to Hon. Robert P. Porter, superintendent of census.

Mr. Clower suggests that the investigation be extended to cities of 5,000 and over instead of 10,000. The suggestion did not prevail.

Mr. W. H. Lawrence presented a resolution, and asked the secretary to read it.

President Weeks at first ruled that the resolution should first go to the executive committee.

Dr. A. F. Mason, of Boston, appealed from the decision of the chair.

President Weeks changed his ruling, without putting the appeal.

Mr. Wyman thought that all papers and resolutions should go through the hands of the executive committee, so as to prevent advertising, etc.

Mr. Alexander asked the chair to rule on the question if an associate member could appeal from the decision of the chair.

The chair said he could not.

The resolution was then adopted. It asked for a reduction of the freight classification of arc electric light carbon.

Mr. C. R. Huntley moved that a committee of five be appointed on nominations, to report Friday morning. Carried.

The chair appointed Messrs. Huntley, Peck, DeCamp, Beebee and Francisco.

Mr. DeCamp moved that the next meeting be held at Cape May. Carried.

Adjourned to 9.30 A. M. Friday.

FRIDAY'S PROCEEDINGS.

On Friday morning, February 14th, at the usual time, the Convention was called to order by the chairman. The principal subject to be disposed of at the forenoon session was the election of officers. When this point had been reached in the order of business, nominations were presented and the ballot was cast, resulting as follows: President, Marsden J. Perry, of Providence; vice-presidents, E. W. Maher, of Albany, and C. L. Edgar, of Boston; executive committee, C. R. Huntley, E. R. Weeks, James English, M. D. Law, John J. Burleigh, M. J. Francisco, A. F. Mason, John A. Seely and H. K. Thurber. Dr. Mason, of Boston, renominated Mr. Weeks, the retiring president, in very complimentary terms, but Mr. Weeks declined the honor.

The new president, Mr. Marsden J. Perry, is vice-president and general manager of the Narragansett Electric Light Company, of Providence. He is closely identified with electric lighting interests, and the Convention is to be congratulated on its happy choice in selecting Mr. Perry for its chief executive.

After the new officers had received the congratulations of their friends, business was resumed, and Mr. F. J. Sprague, of New York, proceeded to read his paper on electric railways, which will appear in our next issue.

Mr. Sprague's paper was received with much applause, and a vote of thanks was passed. Papers by C. C. Haskins, C. A. Harber and J. E. Lockwood, concluded the reading of addresses. The report of the National Committee on Legislation was received and adopted, as was also that of the executive committee.

AFTERNOON SESSION.

The newly elected president, Mr. Marsden J. Perry, thanked the Convention for the honor which it had conferred on him, and complimented his predecessor in office. His remarks were well received.

Mr. Edward H. Johnson, of New York, spoke entertainingly of Edison's first work on the phonograph. A large audience enjoyed an exhibition of the phonograph. The following committees were appointed: On underground work, J. E. Lockwood, C. H. Wilmerding, S. S. Wheeler, T. Carpenter Smith, D. E. Evans. On revision of the constitution, A. F. Mason, A. J. DeCamp, Judge Armstrong, M. J. Francisco, E. D. Weeks. On parent and sub-companies, M. J. Perry, J. F. Morrison, Wells W. Leggett, Fred. A. Gilbert, Judge Armstrong, E. R. Weeks. Mr. Cutter, of Chicago, introduced a resolution relating to a code of national insurance rules, which was adopted.

A vote of thanks to the people of Kansas City and the reception committee was offered and passed. On motion, the Association adjourned to meet at Cape May, New Jersey, next August.

GENERAL ELECTRIC LIGHT CONVENTION NOTES.

The Jaccard Watch and Jewelry Company displayed a very fine line of gold, silver and nickel Waltham non-magnetic watches. Louis Kunz, representative.

The John Pratt Company exhibited a line of motor insulation and for use in railway works. The company was represented by E. B. Hatch.

The Royal Electric Specialty Company, of New York, had a space showing Young's automatic cut-out. J. B. Halsted was on the ground to explain the working of the cut-out.

John Roebling Son and Company, represented by Mr. G. C. Bailey, made a neat exhibit of their wire cables, cord, etc.

The Eddy Electric Motor Company occupied a large space at the right of the main entrance in which was shown three of their improved motors, one, two and five horse-power. The five horse-power motor was the new reversible elevator motor on which carbon brushes are used. The company also furnished a five horse-power motor for running an Ide engine of 25 horse-power. The exhibit was visited by all the practical electric light men. The above company was represented by A. D. Newton, M. E. Baird, W. T. Osborn and E. H. McFail.

Munsie & Coles, of Brooklyn, N. Y., displayed different styles of conduit for underground work and house lighting. J. F. Munsie, representative.

The "C. & C." Motor Company was represented by H. L. Lufkin and Floyd Platt. Motors of this make from ½ to 15 horse-power were in operation running fans, etc., and attracted much attention.

Chas. A. Schieren & Co., New York, displayed a number of rolls of perforated belting. The American Link Belting Company occupied a part of the space. C. A. Schieren, Jr., and F. W. Baugher, were on the ground in the interests of the above companies.

The Hill Clutch Works, of Cleveland, O., displayed a 48-inch pulley with clutch, mounted on stand and bearings.

The Rockford Electric Manufacturing Company, Paul Bossart, agent, exhibited a one horse-power motor in operation.

Royal Silk Manufacturing Company were on the ground with a line of their silk machine towels, which are used in place of waste.

The Phœnix Glass Company displayed all styles and sizes of glass shades for incandescent lights. They were ably and generally represented by A. H. Patterson, of New York.

The Fred. H. Whipple Company, of Detroit, Mich., occupied a nicely furnished office in the exhibit hall.

The Weston Instrument Company's space was stocked with their ammeters, voltmeters and reflecting galvometers. Prof. M. M. Garner was in charge.

The Southwestern Electrical Supply Company occupied a space in the south side of the hall. A very fine line of supplies and a one horse-power Perret motor was shown here.

The National Carbon Company was represented by Mr. C. Hayes. The company displayed their different sizes and styles of carbons.

The New York Insulated Wire Company was represented by J. W. Godfrey.

The Vulcan Manufacturing Company exhibited a patent smoke preventive grate (stationary). The company have lately put on the market a new automatic furnace, which is self-feeding, the grate rocking on ball and socket instead of hinges.

Mr. H. D. Stanley, of the Bridgeport Brass Company, was present in full vigor.

The electrical journals, with the exception of the REVIEW, which had a central position, occupied spaces on the north side of the hall in the following order: *Electrical World*, *Western Electrician*, *Electrical Engineer*, *Electric Power*, *Electro-Mechanic*, *Practical Electricity*, *Electric Age*, *Electrical Industries*, *Modern Light and Heat*.

A very neat model of the Triumph compound engine was shown in the hall by J. C Hobert.

The new electric heater, lately invented by C. H. Talmadge, was on exhibition.

Prominent among the many and varied exhibits at the Convention was that of the Jewel Belting Company, of Hartford, Conn., and English, Morse & Company, of Kansas City. The former company displayed a number of rolls of their new dynamo belting, which is manufactured especially for that purpose. The belting is made from the center of selected hides, and treated with a preparation which makes it water-proof as well as noiseless; this treatment also protects the belt from the action of machine oil. The company was represented by Mr. C. E. Newton, secretary. English, Morse & Company, of Kansas City, who are agents for the Jewell Company, are prominent in the Southwest as engineers and contractors, and make a specialty of complete power plants for electric light stations, electric railways and manufacturing establishments. They had on exhibition one of the celebrated "Ideal" electric light engines of 25 horse-power. There being no steam in the hall, the engine was driven from an Eddy electric motor. In one of the fly-wheels was a series of incandescent lamps of variegated colors, presenting a brilliant and attractive appearance. English, Morse & Company also had on exhibition a full line of steam specialties for which they are agents.

The wiring of the Casino hall for the electrical exhibits was all done with the weather-proof wire of the Bridgeport Brass Company. This is a fact to which W. D. Stanley pointed to with becoming modesty.

The Coates House had special electrical *menus* during the Convention.

The attendance of a number of the wives of the delegates of course had nothing to do with the excellent behavior of several of the Easterners.

The sight of two puffing locomotives at the head of the "Electric Limited" was a surprise to a number of Kansas Cityians, who had expected an electric locomotive, without steam, smoke or ashes, to be seen as the power bringing the electrical people in.

Captain Brophy, of Boston, who bears quite a resemblance to Mr. Edison, was introduced as the famous inventor at some of the Missouri towns, and the citizens were given the opportunity to shake his hand, and the way both sexes crowded forward for the privilege almost paralyzed the captain.

A basket of flowers was distributed among the ladies on the electric limited, Col. Ransom, of Boston, being the thoughtful donor.

The reception at the Commercial Club was a very pleasant one and largely attended. President Faxon welcomed the visitors, and President Weeks spoke in behalf of the Association in response. Other brief speeches were made, and a very pleasant social evening followed in the very comfortable rooms of the club.

The Committee on Reception, from Kansas City, were untiring in their efforts to look after the comfort of visitors. Messrs. Rusling, W. W. Smith, H. C. Sprague, Geo. M. Meyers and others, were prominent in this kind work.

The trip to the Excelsior Springs was almost universally attended by the delegates, a special train being provided by the Chicago, Milwaukee & St. Paul Railway Company.

The enterprising Central Electric Company had its exhibit in connection with the Gate City Company, and was represented by Messrs. W. H. McKinlock and F. W. Cushing, president and secretary, respectively.

The Okonite Company had a fine exhibit, and in addition, W. L. Candee and Geo. T. Manson were present with their usual genial and persuasive grace.

The Detroit Motor Company, Detroit, Mich., displayed one of their 7½ horse-power improved motors. Great credit is due Mr. A. A. Robinson, the company's representative, for the neat and artistic display and trimming of their booth.

The Edison Machine Works and Edison Manufacturing Company occupied a space in the north end of the gallery, and filled the same with a full line of insulated wires, cables and cord. Mr. J. F. Kelly represented the above companies.

The Electrical Supply Company made a very fine display confined to electric light supplies of every description. A large Japanese parasol was suspended over the exhibit, and on every rib a 16 candle-power incandescent lamp. Mr. F. S. Terry, assisted by G. T. Hewes, represented this company.

The Munson Belting Company displayed a number of rolls of their belting, including one roll of belting 48 inches in width. J. H. Shay was on the ground, as usual.

The Rockford Electric Mfg. Company, Rockford, Ill., Paul W. Bossart, agent, displayed a one horse-power motor in their exhibit space. W. L. Danahowl assisted Mr. Bossart.

The Standard Carbon Company, of Cleveland, Ohio, made a fine show of all sizes, styles and qualities of their carbons. Mr. J. B. Crowe, V. P. of the Company, and Will Low, late with the Central Electric Company, of Chicago, looked after this company's interests.

Chas. D. Jenney, of the Jenney Electric Motor Company, of Indianapolis, Ind., was on the ground with a one horse-power motor, and furnished power for a coffee mill.

Mr. E. V. Cherry, President of the Standard Electrical Works, Cincinnati, was present, taking in the Electric Light Convention, with the same zeal that he had for many years shown at telephone gatherings.

The Gate City Electric Company exhibited a full line of electric supplies, consisting of tools, tape, Okonite wire and cables. Mr. J. W. Mason and G. W. Johnston were present and entertained royally.

The National Electric Manufacturing Company, of Eau Claire, occupied a large space in the east end of the hall, where they exhibited a 750-light alternating dynamo, with station apparatus. Karl Kammeyer, of Eau Claire, and Thomas Wolfe, of Kansas City, represented the company.

George Cutter, of Chicago, displayed a large assortment of supplies and Bernstein lamps. Major Evarts and Mr. Cutter filled the space behind the show case.

Ansonia Brass and Copper Company, Chicago, filled their space with their renowned insulated wire, cables and cord, Mr. Gilbert N. Smith in charge.

The Crocker-Wheeler Company exhibited a number of fan motors in operation, which greatly added to the comfort of the hall, which was rather close at times.

W. G. Price displayed a sample of improved car fare boxes for use in street railways.

The Kansas City Engineering Company, agents of the Sprague Company, displayed a one-fourth horse-power motor operating a large exhaust fan; also a five horse-power motor of the above company's make.

The Sprague Electric Company occupied nearly the entire gallery, and was the largest space in the hall. In this was exhibited photographs, albums, etc., showing the different applications of motors and views of the numerous electric railways equipped by this company. A prominent feature of the exhibit was a large map, 8x14 feet, on which was designated the location of the street railways throughout the United States using the Sprague system.

J. H. Brill Company exhibited a model of their improved No. 6 truck, which was greatly admired by the many visitors. The company was represented by Bernard H. Schmidt.

Prof. Henry A. Rowland, of Johns Hopkins University, as intimated in his letter to the REVIEW, was not present.

Prof. Elihu Thomson, of Lynn, Mass., was unable to attend.

The absence of many of the regular attendants at these conventions was particularly noticeable. Among these absentees were Gilbert and Ridlon, of Boston; Moses and Lynch, of New York; Morrison, of Baltimore; Redman, of Rochester; Rhodes, of Niagara Falls; Orford, of Bridgeport; Duncan, of Pittsburgh; Officer, of Council Bluffs.

THE ATTENDANTS.

Among the delegates and visitors present were the following named:

ATCHISON, KAN.—J. A. Chisham.

BOONVILLE, Mo.—C. C. Bell.

BOSTON.—A. K. Page, Capt. Wm. Brophy, H. J. Conant, D. J. Flanders, A. F. Mason, C. M. Ransom, Dr. Robert Amory, F. E. Barker, S. E. Barton, D. Kilicutt, G. L. Austin, F. A. Wyman.

BALTIMORE.—D. E. Evans, A. C. Tudor.

BUFFALO.—C. R. Huntley, F. G. Raichle.

BRIDGEPORT, CONN.—H. D. Stanley.

BROOKLYN.—C. F. Coles, J. F. Munsie, E. J. Cook, E. F. Peck.

CAPE MAY, N. J.—F. T. Walton.

CARROLTON, Mo.—James W. Lacy.

CINCINNATI.—E. V. Cherry, Emile Kahn, W. H. Jones, J. C. Hobart.

CLEVELAND.—J. B. Crouse, W. H. Lawrence, W. C. Hayes, Frank A. Rogers, B. F. Miles.

CHICAGO.—C. G. Armstrong, G. C. Bailey, W. J. Buckley, E. V. Cavell, F. W. Cushing, Geo. Cutter, A. C. Durborow, Jr., A. L. Davison, D. B. Dean, (ELECTRICAL REVIEW), D. T. Everts, D. S. Geer, C. E. Gregory, Ernest Hoefer, W. A. Kreidler, Alex. Kempt, H. P. Lucas, W. W. Low, E. L. Powers, G. M. Smith, J. H. Shay, A. E. Smith, J. Stedman, F. S. Terry, John Young, Geo. Atkinson, W. H. McKinlock, A. H. Bauer, S. S. Badger, C. H. Cone, A. L. Cloud, F. E. Degenhardt, J. W. Dickinson, Fred. DeLand, C. W. Emery, E. D. Floyd, H. A. Glasier, Geo. T. Hewes, C. C. Haskins, G. A. E. Kohler, S. S. Leonard, H. T. Lockwood, W. B. Pearson, John Ritchie, B. H. Schmidt, B. E. Sunny, R. J. Randolph, H. P. Lucas, C. H. Wilmerding, H. E. Longwell.

DALLAS, TEX.—D. M. Clower, Wm. Clower.

DETROIT, MICH.—J. A. Campbell, J. E. Lockwood, A. A. Robinson, Fred H. Whipple.

EXCELSIOR SPRINGS, Mo.—E. B. Kay.

EAU CLAIRE, WIS.—Carl Kammeyer.

FORT SCOTT, KAN.—H. S. Mitchell, N. C. Thompson, A. W. Walburn.

FREMONT, OHIO.—C. T. Richmond.

FORT WORTH, TEX.—E. J. Jennings.

GREELEY, COL.—B. D. Sanborn.

HARTFORD, CONN.—C. E. Newton, E. B. Hatch.

HAYES CITY, KAN.—I. M. Yost.

HOUGHTON, MICH.—J. R. Dee, J. T. Daniels.

HUTCHINSON, KAN.—L. A. Beebe.

INDIANAPOLIS, IND.—Chas. D. Jenney, Geo. C. Fyle, h. A. Boyd.

KANSAS CITY.—G. W. Johnston, C. A. Ross, O. H. Schramm, Jas. Scammon, W. F. Sargent, D. K. Smith, W. Wiley Smith, D. A. Williams, E. R. Weeks, Thos. Wolf, W. B. Grimes, Jr., G. W. Hart, F. Howard, C. A. Harber, F. K. Hoover, F. K. Holtzinger, Ira C. Hubbel, L. S. Jenkins, W. B. Knight, Edw. Lassell, C. W. McDaniels, F. A. Kettler, W. D. House, Horace Keefer, W. G. McGonnon, R. Macmillian, J. W. Mason, A. M. Morse, W. T. Osborn, M. S. Porter, H. M. Porter, C. H. Rusling, T. H. Reynolds, Paul Bossart, L. C. Bair, M. E. Bates, J. S. Chick, T. F. Clohesey, J. D. Cruse, H. M. Cutler, O. W. Ditsch, G. H. Elmore, T. F. English, C. C. English, W. B. Grimes, W. H. Woodring, G. M. Meyers, Floyd Platt, C. H. Talmadge.

JACKSONVILLE, ILL.—Frank M. Doan.

LINCOLN, NEB.—M. J. Bigelow.

LOUISIANA, Mo.—W. T. Johnson.

MCPHERSON, KAN.—J. B. Darrah, B. A. Allison.

MERIDEN, CONN.—F. E. Knight.

MILWAUKEE, WIS.—Henry Andrae, B. W. Smith.

NEWTON, KAN.—W. C. Oldfield, L. McCormick.

MONTREAL.—W. R. Kimball.

NEW YORK.—G. M. Phelps, C. W. Price (ELECTRICAL REVIEW), C. E. Stump, C. A. Schieren, Jr., F. J. Sprague, G. P. Tobey, J. A. Seely, B. R. Western, S. S. Wheeler, E. H. Johnson, H. W. Leonard, A. T. Mayer, H. L. Lufkin, P. H. Alexander, J. F. Kelly, C. A. Benton, W. S. Kelly, W. L. Candee, W. J. Johnston, E. T. Greenfield, Geo. T. Manson, C. R. Field, A. H. Patterson, A. V. Garratt, J. B. Taltavall, J. W. Godfrey, R. J. Gray, J. B. Halsted, A. J. Stott, J. P. McQuaide, David Chalmers, H. M. Haines, W. S. Turner.

NEWARK, N. J.—C. O. Baker, Jr., M. M. Garver.

NORTH EAST, PENN.—A. L. Daniels.

NEW BRITAIN, CONN.—T. H. Brady.

PHILADELPHIA.—A. J. DeCamp, M. D. Law, G. F. Porter, W. R. Hood, J. A. Pentz, T. C. Smith, E. G. Willyoung.

PINE BLUFF, ARK.—J. H. Atkin.

PITTSBURGH.—A. E. Carrier, M. M. Mead.

PEORIA, ILL.—Lafayette Cole, Martin Kingman.

PROVIDENCE, R. I.—M. H. Hartwell, M. J. Perry.

PUEBLO, COL.—C. M. Davis.

QUINCY, ILL.—A. B. Faunce.

RED JACKET, MICH.—J. D. Cuddihy.

RICHMOND, Mo.—J. R. Hamacher.

RUTLAND, VT.—M. J. Francisco.

SPRINGFIELD, ILL.—A. L. Ide.

ST. JOE, Mo.—T. A. Chadwick, J. A. Corby, F. D. Rusling.

ST. LOUIS.—P. C. Burns, F. W. Baugher, F. E. Costello, L. M. Fishback, C. W. Hazeltine, G. Parker, P. L. Rose, F. H. Pond.

SYRACUSE, N. Y.—A. P. Seymour.

TOLEDO, OHIO.—C. R. Faben.

VINCENNES, IND.—H. W. Frund.

WINDSOR, CONN.—A. D. Newton, M. E. Baird.

WASHINGTON, D. C.—Fred. Royce, John Lynch.

WASHINGTON COURT HOUSE, O.—Jerome Penn.

WICHITA, KAN.—J. W. O'Neill, E. M. Reed.

WILKES BARRE, PA.—J. C. Bridgeman.

A bill recently introduced in Congress appropriates $75,000 for laying underground telegraph and telephone wires for connecting the departments of the general government in Washington. This is in accordance with suggestions made by the Commissioner of Public Buildings, and, if carried out, will dispense with about five miles of pole lines running through the heart of the city.

The navy department has ordered a board of officers to visit Boston some time next month, to examine into the working of the system of welding by electricity, and to report upon the adaptability of the process of welding boiler flues, etc., for use on the men-of-war. Chains used on naval vessels are all made at the Boston navy yard, and it is thought that the new machine will find employment at that station, as the welding can be done much stronger by that means than by methods heretofore in use.

Papers Read at the Kansas City Convention.

Safety and Safety Devices in Electric Installations.

BY PROF. ELIHU THOMSON, OF LYNN, MASS.

The development of the electrical arts, particularly in the direction of lighting and motive power transmission, has in the past few years, been very great. It has brought with it a demand for very much work of a novel character, as regards the details of plant and methods of installation. It has also entailed, in many cases, elements of risk to life, and danger of fire. How far these risks have been or can be removed by proper attention to details and care in installation, has become an important subject for discussion. How far such risks have been increased by reckless installation of conductors, by faulty materials and supervision, it is not easy to determine. There can be no doubt, however, that electricity, as an agent, in itself is not to be charged with bringing about the results for which recklessness in its use is sufficient to account. That under favorable conditions for discharge through a person's body, electric currents of comparatively high pressure may injure or kill, is not to be questioned for a moment. I have no sympathy with any effort tending to impress a false estimate of such risks, or tending to give the impression that they are absent, when in reality they are existent. I have no sympathy with any efforts to exaggerate such risks, efforts which have not been wanting, indeed, as is well known. The fire risk, as well as the personal risk, involved in electric work is present in a greater or less degree, in accordance with the perfection of the work of installation and maintenance, the provision of the proper safeguards, and selection of the best conditions.

These are matters which are, every day, of growing importance in all the electric industries, not even excepting telephonic systems and other such work, which, if badly arranged and not properly maintained, may cause crosses due to falling wires, etc., to become sources of danger, trouble and annoyance in the distribution of lighting or other currents. There is one fact which is of the greatest importance in this connection, and it is that safe installation means, also, good service. There can be no question that the risk to life *from shocks*, even with bad work, would be removed by not using high potential currents, as they are called; either alternating or direct. There can be no question, also, that a shock obtained from certain characters of current, such as an alternating current, is much less safe than in the case of continuous currents of equivalent pressures. Nevertheless, I am just as firmly convinced that the fire risk is very much less with alternating than with continuous currents of equivalent potential, assuming the work of installation equally good. The fact that it is difficult to sustain an arc, or rather that it is easy to select conditions which will prevent arcs forming with the alternating system, as compared with the continuous current systems of much less potential, is greatly in favor of the former. Hence, switches, fuses, bad joints, ruptured wires, are much less liable to arc and incur risk of fire with alternating than with continuous currents. Would it be possible to work successfully, using only low potential currents of either character? Would we be able to utilize water powers for lighting, without employing pressure of potential sufficient to convey the energy to a distance over a conductor of moderate or nonprohibitive cost? In most cases we would certainly not be so able. Again, to utilize water frontage for cheap coal supply, and to employ compound condensing engines, to ensure small running expenses by massing the machinery at one station, to make use of railroad facilities, etc.; in short, to work under the most advantageous operative and economical conditions, we *must* convey electrical energy by moderately high electric pressures, so as to avoid prohibitive losses or prohibitive cost of conducting wires. If ever our great natural resources in water power are to be developed and utilized, it will be by the employment of comparatively great electrical pressures for conveyance of energy to distant points. If great saving of cost of fuel and other expenses in operating one large steam plant, instead of a number of separate plants with their attendant risks, in large cities, is an object worth seeking, it will be found in the conveyance of electric energy at fairly high pressures. It must not be forgotten in this connection that even with very low pressure currents, safety from fire risk is only to be secured by careful construction and supervision, and that risk of fire often involves personal risk. Subway and underground conductors have caused manhole explosions, with both low and high potential currents. Such accidents are generally explained by accumulations of coal gas formed in the manhole and subsequently fired by the electric arc or spark of a leak. This may be and probably is sufficient explanation, but another may be given—the evidence of the possible correctness of which I have witnessed. A heavy leak or overheating occurring at some point of the conductors near the manhole, may generate directly a large volume of inflammable gas from the distillation of asphaltum or other substance used as an insulator, and this gas, mixing with the air of the manhole, may be easily fired by the heat of an arc or spark subsequently to its production, and cause a violent explosion. The remedy is thorough and continuous ventilation of the spaces in the manhole and subway. An instance of a storage battery car being wrecked, from a similar cause, is on record. In this case the battery conductors were probably overheated by a short circuit and filled the compartment in which the batteries were with inflammable gases, and the further heating fired the mixture, the result being a violent explosion, which greatly damaged the car. Such accidents always involve personal risks, and are to be prevented by simple means properly applied.

But the popular mind is so used to gas explosions that the newspapers have only a few lines to devote to them, while an accident in which an electric shock is obtained, although it has taken place through disregard of some simple precaution, is more than likely to be copiously provided with head lines and harrowing details. I even find one of the journals, whose name states its scientific character, attributing both the Lynn and Boston fires to electric wires. There is on exhibition at Lynn as a curiosity, the oil stove which caused the fire, and inquiry into the case of the Boston fire has, so far as I can learn, rather tended to discredit the theory than to confirm it. Notwithstanding these facts, it is true that under faulty conditions of lines or plant, fires may arise, and hitherto have arisen, traceable directly to the heating effects of electric currents. Perhaps if the accidents which happen serve to enforce the fact that the best work, the most thorough provision for emergencies, and careful consideration of details of electric work will be requisite to secure proper safety in the electrical field as in other clases of work, their mission will be fulfilled. Severe and inconsiderate as has been the dealing with the wire question by the authorities in New York City, yet it cannot be denied that the condition of the overhead circuits there had been, in the past few years, going from very bad to much worse. In many cases considerations of safe working would seem to have been neglected in the competition for business. The lines of four or five different companies competing in the same territory might be found, the result of this condition being, without doubt, to enormously increase the risks. There have been hints of the coupling up of dynamos in series, and so increasing the potential of lines already worked at too high pressures in relation to their condition of insulation, and to the placing of the lamps or other work supplied from such lines. Along with this we find the air full of telephone, telegraph and signal wires, of various sorts, none too secure from rusting out or breaking. Many of these latter wires could, no doubt, be easily buried underground with advantage to the service, but it is certain that to attempt to bury the electric light wires in a hasty, ill-considered fashion, merely for the sake of getting rid of overhead lines, would be productive of no good results, either in avoiding risks or bettering the service. The placing underground of very many of the wires now found overhead in our large cities is, in my opinion, a matter which must come in time, but it should be done carefully and gradually, so as to secure the best work. Meanwhile the re-organization of existing wires, the removal of unused wires or redundant wires, as where two systems or circuits in the same territory overlap while serving substantially the same purpose of supply, and the use of first-class insulation on the wires, would go far to securing safe working and uniformly good service. Besides all these precautions, and outside of them; wherever the conditions are and have been favorable to safe installation of overhead or underground circuits, there are to be found a class of appliances which are called "Safety Devices," inasmuch as it is their purpose to provide for abnormal conditions and remove risks which, with perfect working and maintenance, are usually absent, but may be brought into existence by accident or unforeseen defects. Such risks may be by outside interference with lines, or by lightning, by falling or poorly constructed signal and other wires upon overhead wires, by unusual wind or sleet storms, by failures of all kinds, as in the workings of lamps, switches, etc. It is here that the safety device is found to be useful. Such devices are to the electrical systems what check valves, overflows, traps and safety valves, are to the hydraulic systems. There is, of course, no room for doubt that if the insulation of all parts of the plant, as dynamos, lines, lamps, etc., were maintained always at its best, and if the mechanical strength of lines, hangers, poles, etc., could be always relied upon, and further, if the effects of lightning induction were never present, there would be but little use for purely electrical safety appliances, such as those for guarding against leaks and diversions of current. To expect such perfection of conditions is to expect too much. A rigid system of frequent testing can, however, go far to anticipate and to discover the departures from such safe conditions, and enable the disturbing conditions to be removed. Nevertheless, there will always remain opportunity for unskilled or careless handling so altering the condition as to provoke trouble; there will always remain chances of undiscovered defects, chances of interference from outside. The effects of lightning are an important factor during the thunderstorm season. I am driven to conclude, therefore, that safety devices are, and will continue to be, important factors in electric work. The more thoroughly they are adapted to their intended functions, the greater the security, and the more extended their application. That system of distribution will surely survive, which, while involving economy of first cost and maintenance, at the same time secures the greater safety and embodies the greatest flexibility. I assume, of course, that the running economy is practically good in every case.

In the very early days of arc lighting, with a single lamp only on a circuit, the idea of safety from fire or shock did not present itself. When such lamps began to be run in a series of eight or ten, or more, the need of an efficient cut-out was felt, so that a defective lamp failing to feed its carbons should not burn with a long arc or flame, and so involve risk of fire, or extinguish the other lights. This need was met in 1876, by Lontin, who used the shunt circuit to actuate a shunting switch around the defective lamp. The Brush cut-out followed, and was a decided improvement on Lontin. Fuller and others early went over the same ground. The film cut-out, or shunting switch, depending on a small thickness of a high resistance insulator, such as oiled paper, to prevent its closure, which paper film is overcome by the difference of potential or pressure between the carbons when a long arc forms, was brought out by the writer, and later, the "vacuum cut-out," a modification which rendered the device self-setting for repeated action if needed. It is scarcely necessary to add that spark catchers and enclosing globes with wire nettings, were early additions to arc lamps to prevent sparks reaching inflammable material near by, and the globe also in addition served to diffuse the light. Current regulators were additions to arc machines, and acted to prevent undue current, and secure thereby not only safety, but good service. The fact that good service in most cases is assisted by appliances which ensure the safety, or is even dependent on them, is a fact which ought not to be lost sight of in connection with the general subject of electric installation.

The early installations for arc light in and out of buildings, were made with bare wire circuits, and it is a satisfaction to me to recall in these days of forgetfulness of the benefits conferred by electric industries, and exaggeration of the dangers of properly installed plants, a case which occurred in connection with one of the earliest commercial plants of the Thomson-Houston arc lights in 1879. The machine of about eight or nine lights capacity, with bare wire lines, was put up in a large brewery in Philadelphia; two arc lights lighting the stables in which were 30, or more, valuable horses. One evening a fire started in the hay-lofts in the story above, and where there were no lights of any kind used, and soon the flames and smoke spread to the stable room and menaced the horses. The proprietor happened to think to start up the electric lights at this juncture. Their brilliant rays saved the animals, which were removed without trouble, and the lights were kept burning during the progress of the fire. Its spread was limited by the efficient work of the fire department. The arc lamp globes were at times full of water, but, to the surprise of the firemen, the lights were not extinguished but assisted them in their efforts very materially.

As the number of arc lights placed in a circuit grew, the necessity for thorough insulation was appreciated; the effort to secure which, for arc lighting lines, has resulted in very great improvements being made in the past few years. So far as electric wires go, the best "safety device" is a perfect insulation. In order that this matter shall not assume the condition of a trial of strength between armor and armor-piercing, as in naval affairs, with a constant growth of both, the advantage always being on the side of armor-piercing or insulation piercing, I think that efforts to run more than a certain limited number of arc lights in series should be discouraged. Eighty or 100 lights, or even more, have been run and could doubtless be run safely under favorable conditions, but I doubt that such conditions can be found in city work, the interfering actions are too numerous, while the maintenance of good conditions would be too expensive. Without such good conditions, there would be grave dangers involved.

It has become a practice to use incandescent lamps of low resistance in series on arc light circuits or other constant current lines, and much useful work is so accomplished. Here, again, safety from fire risk depends on certain safety devices, the most important of which is the shunt-forming device, when the carbon lamp conductor breaks. A number of very simple and effective devices are employed for this shunting action. Without such devices the tendency to arcing would be very great It is advisable also not to rely on any one device alone for this purpose, especially if the lights are used indoors. Here the film cut-outs may supplement the action of a shunting device operated by the heat of an arc set up when the lamp carbon becomes discontinuous. These latter are the fusing cut-outs, twisted wire cut-outs, and others which connect the lamp wires together in the lamp, and so form a complete shunt. Other forms exist, notably the third wire cut-out, acting by diversion of current from the arc to a third or intermediate wire between the lamp conductors.

As in the case of the other devices mentioned, the perfection of operation of one, or a combination of several of these shunting contrivances, conduces not only to uniform service but to absence of risk. Absolute cut-off switches are now in common, if not in universal, use to cut-out loops of series circuits, and in a measure may, therefore, be regarded as safety devices, but not of an automatic character. Outside of these factors just mentioned, safety in such circuits rests in insulation and maintenance, avoidance of leaks or crosses, proper placing of wires and lamps, avoidance of partial contacts or partial ruptures of the circuit at joints, binding posts or switches. In series circuits, the main object is to avoid a concentration of, or establishment of, large differences of potential at points in the line where the current finds or can find a path; in low potential multiple arc systems as used in direct incandescent work, the object is to avoid concentration of current at points where such current cannot find a sufficiently low resistance path. Hence, there are required cut-offs for current when excessive in any part of the system. Short-circuits of accidental character must be provided against. If the safeguards are not ample, a more potent fire producer than a short-circuited section of an extended multiple arc system is hard to find. Take out your fuse wires and replace them with copper wires, a practice, instances of which were not difficult to find in times past, and a short-circuit may quickly heat a long line of wire in a building, so as to set fire to the insulation of the wire and surrounding woodwork. The fusible wire cut-out, if properly made and used, is an effective preventive of such risks, though magnetic cut-offs are preferred by some, though more expensive. The magnetic cut-offs, which are simply open-circuiting switches, controlled by magnets in the branch or line so as to open it on excessive current, have the advantages of promptness, avoidance of the scattering about of fused metal, and can be reset without any renewal of material, so differing from the case of a fuse wire. Another risk in such systems is that of creeping of current from main to main over moist surfaces, or partial conductors, in amount insufficient to blow a fuse, but sufficient to convert enough energy into heat to set a fire. Good water-proof insulation of wires avoids this risk if the insulation remains intact. I consider the plan of running the two branch wires, excepting the larger ones of the system, near together or close together, as excellent in avoiding this risk, provided the wires are encased in insulation and covered in, or run in a tube. In case of a leak from main to main, the more quickly the fuses blow, the better, and the proximity of the wires assists this speedy action, while between the wires there is not at any time enough combustible matter to set afire by the short-circuit. Enclosure in a tube effectually shuts off possibility of flame reaching combustible matter before the fuse blows. This does not apply to the heavier mains, capable of carrying thousands of amperes, so well as it does to the smaller branches. I am glad to note here that the tube or conduit system appears to be well worked out for inside wiring by the Interior Electrical Conduit Company.

Another thing to be avoided in extended systems of multiple arc work is grounding or leakage to ground of current over resisting surfaces or materials. The tube system is useful here as well, and the placing of two wires at difference of potential, near together, assists somewhat, but does not entirely remove liability of grounding. Testing for grounds in the system, taken in sections, is the proper procedure, although this does not provide against all suddenly formed leaks. It may be argued that in this case two grounds are necessary to cause a leak, one on each side of the system, and this is true; but in very extended systems of overhead work, more or less general leak exists which may provide sufficient current to feed, as it were, a local leak to ground from either main.

Let us now deal with what is called the alternating, or induction system of supply,

in which the local, or house mains, are separate from the primary mains, and of much lower potential. For lighting purposes the system is very flexible, and enables distance to be overcome. The secondary circuit is, or should be, entirely out of connection with the primary mains of high potential, and the potential differences of the secondary circuit may be so low as to be incapable of giving a severe shock under the conditions of use, and to be almost incapable of setting afire, on account of the absence of arc-forming tendencies. This is, indeed, an important factor in alternating current work, and conduces to the perfect working of switches and cut-outs, and the prevention of diversion to ground. Good work is all that is needed in this case to abolish all risks, if we leave out the main high potential current. The local line is unaffected by leaks or grounds at other parts of the system, and is, therefore, in this respect, in a better condition than is found with the consumer's lines in any direct system of supply. On the other hand, all the cases in which persons have received a shock from an alternating current of 1,000 volts or upwards without being killed, are fortunate accidents, for there cannot be the slightest doubt that such current can and will kill under conditions favorable to its passage through the body. There are many cases of severe shocks having been obtained from such currents without permanent injury. On the other hand, there is a sufficient number of fatalities on record to sustain the position taken. The risks with higher than 1,000 volts alternating current are, of course, greater. It must not be forgotten, in this connection, that the actual potential differences in an alternating current of 1,000 volts are higher than that figure, and may be, at every wave, upwards of twice as much. This confers on such currents an actual and measurable striking distance between the two mains. As with arc lighting lines, the main or primary wires, if overhead require to be kept thoroughly insulated and free from leaks to ground. The covering for the wire should be capable of resisting moisture, and the wire used be strong enough to prevent any possible breakage. If the primary wires break and come down, they are still kept charged from the dynamo, which is not always the case with arc light lines. If, however, the insulation is strong and perfectly good, the risk to life is small in such cases. There is one fact I wish to impress, however, and it is, that, with a perfectly insulated set of alternating primary mains feeding transformers, there still remains the static capacity of the line or cables and transformers, and this may be of an amount sufficient, if a person is grounded and touching the primary line, uninsulated, to give a severe if not a fatal shock. This inductive shock or discharge is, of course, far more pronounced with ordinary underground conductors than with aerial lines, and increases with the size and number of transformers and the extent of the line. It also increases as the voltage of the primary line is increased. Hence, it is quite important that no leak or connection exist between the primary line and a secondary in such system, or otherwise there may be a transfer of potentials of the primary line to the secondary so as to involve risk of shock to the consumer, or risk of fire from leaks to ground indoors. It will not do to say that such connections do not often form, for they may form from defects in construction, from moisture, and particularly from lightning discharges. A person standing on a damp floor, leaning on a steam radiator, touching a gas pipe grounded, or in other ways, may, if he handles or touches the secondary line at any part of it, be in peril of severe, if not fatal, shock. What was without this condition a most harmless local line, becomes most dangerous.

The writer early recognized this danger, and felt that unless it was provided for, the induction system was not advisable for general use. As a consequence, the expedients of grounding the secondary, or of surrounding the secondary by a grounded sheath, or of cutting off absolutely by automatic means the local line when connected with the main line, or of automatic grounding of the secondary by insulating films or spaces which are punctured or overcome by the potential of the primary when connected with the secondary, were devised as safety devices. The grounding of the secondary is the most simple and effective if good grounds be made. It must, however, be done with certain precautions to insure the best results.

The second expedient of a grounded metallic sheath between the primary and secondary is persistently called "Kent's sheath" when alluded to by our English cousins, despite the fact that it is American in its origin. It is effective as a protector, as it carries to ground any discharge leaving the primary before it reaches the secondary. The sheath is easily made by placing a somewhat open wrapping around either the primary coil or the secondary coil of the transformer made of flat metallic ribbon or insulated wire, the ends of which are grounded when in use. The course taken by the wrapping is around the wire of the coils at right angles to its direction of winding. The automatic absolute cutting off of the connection between the transformer coils is also effective, and has undergone several modifications in other hands. The last protective device mentioned above leaves the secondary insulated from the ground until a contact or leak from the primary takes place, when an automatic ground is made. One of the forms consists in the interposition between the ground and the secondary coil or line of a film cut-out, or thin paper film between two metal buttons pressed together, one button connected with the ground, the other with the transformer secondary. This device is very effective in securing a safety ground connection of the secondary when the primary leaks to it. A well constructed transformer properly installed will not, except by accident, lose its insulation between primary and secondary, and such insulation should always be many times that otherwise requisite, so as to have a margin of safety; but the safety device is none the less a necessity in its use.

I consider that a properly arranged double wire cable, well insulated, constituting the primary line, laid in ventilated pipes underground, transformers connected therewith, also enclosed in a grounded metal case, as in the cellar of a building, a secondary line of low potential, grounded, or provided with safety devices as mentioned, embodies as safe a system of incandescent electric light distribution as can be devised, both as to risk to life and danger of fire. It ensures complete safety to all the consumers, and to each one individually. It enables long distance work to be undertaken, and allows low voltage lamps to be used with their increased economy. The risks are confined to the electric station and the primary lines, which should be handled by men who know their business. The non-commutation of the current at the generators is another advantage, of course. The disturbing influences, which in the best organized plant may be introduced by lightning, are serious and sometimes destructive. It is not that the lines are struck by lightning in causing such troubles, but the mere *inductive* current or discharge from a flash of lightning is quite sufficient. It puts upon the line potentials of many thousands of volts and tends to break down insulation everywhere. Lightning arresters are therefore important safety devices in more senses than one. They save the machines in the station and the apparatus outside. In the alternating system they save from puncture the insulation between primary and secondary coils of transformers and between the turns of the primary coils itself. Every plant, then, should, if subject to lightning induction, be provided with efficient lightning arresters or dischargers.

A discussion of this general subject, however brief and necessarily restricted in scope, would be very incomplete without allusion to the subject of contact with telephone or telegraph wires with electric light conductors. Underground and in conduits such contacts could not easily occur though leak might readily take place between lightning conductors and other wires. In any case, there is a risk of such wires carrying current into buildings or to positions bringing about shocks to persons, thus involving risk of fire or danger to life, or both. As a consequence a set of safety devices have been brought out under various names whose purpose is to cut off dangerous currents when they reach or traverse lines, such as those of the telephone or the telegraph. It is my opinion that in cities the provision of approved devices of this kind should be compulsory. Most of those which I have seen are not well enough designed or made to be perfectly relied upon, but are much better than nothing and may possibly suffice. Such apparatus, however, should be made so as to be perfectly reliable and undergo a regular inspection. Mere fuses, even if made long, are not enough. There should be placed in ever circuit liable to contact with lightning or such like conductors and at a place in the circuit where it enters a building, a protective device which, to be complete, should shunt or absolutely cut off the section of wire indoors, or ground the same in case of abnormal current on the wire or abnormal potential.

There is much more to be said on this subject, and I am conscious of only having touched upon certain important matters in this paper. If I have succeeded in pointing the way to better conditions in any case, I shall be more than satisfied.

To sum up briefly, safety in outside work means care in placing, maintaining, and insulating conductors, whether used overhead or below ground. This means the employment of only good linemen, and not men who are ready to incur risks through a reckless disregard of conditions of failure to comprehend their importance. Men who have done telephone or telegraph line work are not necessarily prepared to undertake electric light and such other work with the best success. Safety in inside work means, primarily if admissable, separation of the inside circuit absolutely from the general supply mains, and in any case it means that good, careful workmanship is requisite, and that the employment of safety devices, amply sufficient to do the work required of them in case of accident, is imperative.

Safety from current entering buildings upon telephone, telegraph and other wires, means first, a more systematic placing of such lines apart from electric mains, whether above ground or below, guard wires and insulated wire for such lines, stronger wire, especially for telephones, and the employment of safety devices in case of accidental leaks or crosses occurring with electric mains, of either low or high potentials, and a periodical inspection by proper officers.

Carbon Tests.

BY E. F. PECK, BEFORE THE NATIONAL ELECTRIC LIGHT CONVENTION, FEBRUARY 11–14, 1890.

The first electric light of any consequence was used by Sir Humphrey Davy, in 1810. He had discovered that when the two terminals of a charged electric circuit were separated a short distance, an electric spark would pass between these terminals by evaporizing the material of which the electrodes were composed, and the vapor thus produced would continue to carry the current between the electrodes, and that these vapors together with the highly incandescent solid ends of the electrodes would emit a powerful light. The vaporized material bridging the space between the terminals of the electric circuit he denominated the electric arc, for the reason that these vapors would pass in a curved path between the two electrodes. Sir Humphrey Davy demonstrated this interesting phenomenon by using a great variety of material for the electrodes, and he found that the most brilliant effects were produced when the electrodes were made of carbons. The carbon used by him was a charcoal made of various woods. It was found, however, that the charcoal, from whatever wood it was made, always had a considerable electrical resistance, and was so rapidly consumed that it could not be used for the production of arc lights for practical purposes, such as general illumination. Other electricians took hold of Sir Humphrey Davy's discovery, and their efforts were directed towards the discovery of materials for the production of electrodes of greater durability and better conductivity. It was finally discovered that carbon deposited in the neck of gas retorts possessed a higher degree of conductivity and was exceedingly hard, and, therefore, would be very durable when used as electrodes for arc lights. Rods or pencils of this gas retort carbon were made and shaped at great expense and trouble, and they were found to be excellent substitutes for the charcoal electrodes, still these gas retort carbons could never be used on a large scale for the reason that they could be shaped to the required form only at a very great expense, being exceedingly hard.

The next step in the improvement of carbon electrodes for arc lamps was made in 1842, when Bunsen invented what he called the "Plastic" carbon as the negative electrode of his battery. This carbon electrode was made of various mixtures of powdered charcoal, molasses, sugar, etc. It could be shaped to any desired form and was made by Bunsen in the shape of hollow cylinders and flat plates. When it was found that this carbon electrode could be used to advantage for the production of electric arc lights, it was at once substituted for the gas carbon. This substitution was not a universal one, for as late as 1873 and 1874, Professor Tindall was in the habit of using gas retort carbons in the production of electric arc lights, although he complained bitterly to his audiences that the production of his carbon electrodes involved great expense and trouble. The carbons burned at the Centennial Exposition in 1876 were of this material, but we have no date of their life or resistance. They were made by Carré, of France, and the current was from a Gramme machine. From 1843, when Bunsen invented this "Plastic" or moulded carbon, to 1879, many inventors of this country and Europe tried to improve on his discovery. Their chief object was to produce a carbon of greater and more uniform density and of higher conductivity. The English patents were especially numerous during this period, and their mixture in the more enlightened state of the art seem very ludicrous. Though some labored at the problem nearly 15 years, on the whole no great improvement was made. This poverty of result was largely due to the fact that the dynamo apparatus of the day was unknown. All arc lights were produced by currents generated by batteries. The modern arc lamp with its simple but effective mechanism was unknown. The arc light was only a curious laboratory plaything generated expensively, and burned disadvantageously. The proper experimental condition to enable an inventor to produce good carbons did not exist, and the financial stimulus of commercial demands was wholly absent. The modern arc light carbon of commerce is hardly ten years old. It became a necessity as soon as the modern dynamo apparatus was completed, and commercial lighting by electricity was seen to be coming in the near future. The problem may be said to have been undertaken in 1878. The first point was to discover crude carbon that was both pure and cheap. At the suggestion of Mr. Fayette Brown, of Cleveland, Ohio, his son, Mr. A. E. Brown, then experimenting for the Brush Electric Company, tried residue from petroleum. Careful experiment proved this to be the long sought for crude material, nor have the investigations of the past ten years found any better. The next point was to manufacture carbons of the requisite quality. Nearly three years later the Brush carbon was produced. The first cost of these was very high and the demand small. Where carbons are now sold by the hundred thousand, they were then sold by the dozen. Like most new articles the process of manufacture was round-about and tedious, consequently both the cost and market price of carbons ten years ago was very high; the first carbons selling as high as $125 per 1,000. I cannot learn that any tests were made of these carbons for resistance, brilliancy or even exact life. In those days manufacturers were well satisfied if they could make carbons that would burn fairly well, and gave other considerations very little thought because they were relatively very unimportant. Besides Mr. Brush and his associates, there were several others in different parts of the country working at the carbon business on different lines. At Ansonia, Conn., the Messrs. Wallace were experimenting with forced carbons with much success, following the process of Carré, of France. This carbon was very dense and hard, and when sounded gave forth a ring almost like a bell. Not to mention many others, Mr. Thompson, of Newark, N. J., was also in the field, but clinging to gas retort carbons for his crude material, did not meet with the success achieved by his competitors. Since those early days of experimental work, manufacturers have paid special attention to reducing the cost, lowering the resistance, and increasing the brilliancy and life of the carbon. Early in the spring of 1889, at the suggestion of a representative of one of the large carbon manufacturers, I decided to base a year's contract for carbons on the comparative test of the best known carbons in the market. I made two or three tests, taking into consideration simply the life and resistance of the carbons as adapted to the system of lighting we were using. The tests were rather crude, and not made for the purpose of booming any particular carbon, but to satisfy myself as to what carbon I could best afford to burn. The final test was made with a group of Thomson-Houston lamps on a six and one-half ampere circuit; two sets of carbons of each make were placed in the lamps, and each lamp adjusted to the lowest point a quiet arc could be maintained. A record was made of the time of starting each lamp, and they were then allowed to burn; all the lamps had cut themselves out automatically by the burning out of the carbons. The electro-motive force at the terminals of each lamp was then recorded at intervals of half an hour through the day. The result of the test stated briefly was as follows:

Lamps.	1&2	3&4	5&6	7&8	9&10	11&12
Avg. E.M.F.	42.23	42.73	47.16	48.37	47.76	49.66
Avg. inch. brnd. per hour	1.23	1.46	1.44	1.57	1.72	1.69

As will be seen by this table, there was a difference of 7.43 volts, or a saving of about 15 per cent. in the E. M. F. of the best over the poorest carbon tested, and a difference in life of .49 inch per hour, or a saving of 29 per cent. In a station burning 1,000 arc lamps, this means a saving of 64.73 electrical horse-power, without considering the saving in carbons. The figures given above show very plainly the importance of such tests, and I would recommend that superintendents and managers of central lighting stations give this matter their consideration before adopting any special make of carbons.

Nine Years With the Arc Lamp.

BY M. D. LAW, OF PHILADELPHIA.

In being honored with an invitation to read a second paper before the National Electric Light Association, I cannot help but feel that there were points of interest to some of you in my other paper presented at the Niagara Falls Convention. The subject of this paper is one that is of interest not only to every central station man, but also to those who handle arc lights in isolated plants; and if I can give you but one point that is of value, I shall feel amply repaid for my labor. There are a large number of irregularities in arc lamps that can be remedied by a judicious study of their actions, and, after the cause of their trouble has been found, it should be remedied even if the lamp has to be rebuilt.

In order to find the special trouble that arc lamps are subject to, a careful record should be kept of each and every lamp. To do this give each lamp its individual number, which should be firmly attached to the lamp box and never removed, then by the use of a numbered book, allowing a page for each lamp, a record may be kept of all

lamps, where they are, when changed, with the kind and amount of repairs.

This method of keeping a lamp record allows of finding the peculiar trouble that the lamp is subject to, and the remedy can then be applied, preventing any further trouble until the washers, clutches, rods or bushings, have to be removed. If a lamp is continually being changed for the same cause, there is some one thing that is radically wrong, which is causing the trouble, this should be found and rectified; for instance, a lamp may work perfectly on the test rack, but, after being in use for a short time, would have to be changed for dropping. If from the records of that lamp this is found to be its general complaint, then look for the trouble, if a Brush lamp, in the winding—that is, there may not be the proper resistance of wire on the magnets, or there is too great a difference in resistance between them, which should not be more than one ohm or the result is a side puller.

The resistance of the magnets should be kept as near as possible to 85 ohms; never allow more than three ohms variation from that amount.

Binding of the mechanism, large washers, or too high adjustment of the arc, will cause dropping; in hunting for the cause of this trouble in the Brush lamp, I found that, with proper construction, it could be made to work without dash pot or spring, better than the old style with dash pot and spring.

I assume that in a differential magnet there must be a point of equilibrium between the two magnetisms, and that, if the cores were accurately suspended at the center of this point, any veration of current would effect the core quicker if so suspended than if it was forced to or from that point by a spring. This I have found to be the fact. Then by making the lamps so that the core could be adjusted to or from the center of magnetism and get the proper separation of the carbons at that point, would effectually prevent dropping of the carbon rods; and after a Brush lamp is once adjusted in this manner, it will not get out of adjustment until the washers are worn too large. This can be done without glycerine being used in the rods, which is a great source of trouble.

Any point wherein expense is saved in the Brush lamp is in the winding of the cut-out magnet.

Divide the magnet in two parts by an extra fibre head, and then by winding the fine wire at the top, with a resistance of 15 ohms, and the coarse wire can then be wound on at the bottom, allowing the end to make connection with the cut-out armature at least one-half an inch from the head of the magnet, this will reduce the chances of burning out, if there is a bad contact when the lamp cuts out, even if it does burn out, only one wire will have to be removed.

If the following rules are strictly adhered to in the putting together of a Brush lamp, it will be found to burn correctly with but little adjusting:

See that the device carrying the lower carbon holder is parallel with the side rods; also that the screws, etc., at its base work freely, and allow it sufficient lateral motion in all directions to affect the adjustment for which this device is provided.

See that the lower carbon holder is in line with its support, or the carbons will not center.

See that the brass tube carrying the upper carbon holder is straight, smooth, and free from small or flat places, and that it moves freely in its bushings, which should not be too loose, as this will allow the carbon too much lateral motion, and liable to slip past or wedge.

See that the upper carbon holder is in line with the rod.

This last adjustment is very important, and is made by clamping a steel rod of the same size as the carbons to be used in the holder, and revolving it between the thumb and the finger, noting whether the lower end of the testing rod revolves on its own axis or "wabbles"; in the latter case, push the holder up to the lamp box, and, by means of the testing rod, bend it slightly in the proper direction to correct the error, then see that the carbon holder has not become loosened; test again, repeating the process until the desired adjustment is reached.

Examine the lifting washers which surround the carbon rod, see that the hole is counter sunk on each side, so as to make the available thickness of the washer where it touches the rod but little more than a sixteenth of an inch. See that the hole in the washer is of such a size that one side of the washer may be raised one-sixteenth of an inch from the horizontal floor on which it rests, before it clamps and commences to lift the rod. See that the holes in the washer and bushings are nicely polished. The lifting finger, designed to lift the washer, should move freely in its guide and get a good hold under the edge of the washer, and allow the latter to rest flat on the floor under it when the finger is down. In the case of double lamps, the lifting finger should be so adjusted as to lift the second rod one-sixteenth of an inch ahead of the first.

See that the movable brass parts connecting the lifting finger with the movable magnet cores work freely at their joints, so that no binding of the parts may be possible.

The spring which partly supports the magnet cores should be made of steel "pianoforte wire," $\frac{1}{100}$ of an inch in diameter, wound closely over a mandril of such size, that the spring when released shall have an external diameter of $\frac{1}{4}$ of an inch, and shall consist of about 38 turns of wire, exclusive of the hooks at the ends.

See that all the parts of the dash pot are free and do not bind. See that the armature of the cut-out moves freely on its pivot; and when it is down its end is about one-quarter of an inch from the core of the cut-out magnet, and when it is raised and makes contact with the copper wire projecting from the cut-out magnet, that its end comes about $\frac{1}{32}$ of an inch from the cut-out magnet core.

The brass spiral leading from the cut-out armature is not used as a spring, but as a resistance. It must be pulled out or pushed together as the case may require, that it shall exert neither a lifting nor depressing influence on the armature.

This spiral is made of brass wire $\frac{1}{100}$ of an inch in diameter and about 30 inches long before being coiled. The size of this wire is important as it should be of just the right resistance, that the lamps may cut in when the carbons come together; for this same reason the armature is not allowed to come close to the core of the magnet, but should be made to come as close as possible that a better contact may be made, thus reducing the liability of burning out.

The principal improvements that can be made in the Thomson-Houston lamp are, the making of the clutch of German silver or some more durable metal than brass, as the bearing point of the clutch against the rod is so small that it very soon wears and thus throws the lamp out of adjustment. When one of these lamps is found dropping, it can very often be remedied by lowering the adjusting nut No. 692 a trifle, when the lamp will again burn correctly, and, in some cases, this may be repeated several times without any other change in the lamp.

Another great point of improvement in this lamp is, increasing the thickness of the insulations, which are too small in nearly every case, especially is this the case with those under the binding hooks at the top of the lamp box, which I find work excellently well made of porcelain.

When the insulator in part No. 701 gives out, the current shunts through the cut-out magnet, causing what the men term "cut-out armature magnetized," this is a very important point which produces flaming and dropping.

The general causes of the T.-H. lamps dropping are numerous, but if all the working points move freely and without lost motion, it will reduce the number to the few following points: Badly worn spots in the carbon rods—this is a common fault of all arc lamps. The clutch or lifting spring may have lost their temper—these should be made of bright instead of black steel. Clutch arm bent. Clutch or carbon rod bushings may become worn. The adjustment nut No. 692 may be too high, the clutch or tension spring may be too tight. Crooked frames, bent rods or rods striking the chimney, tight bushings, fine wire broken, dirty rods, or the adjustment nut No. 692 being too low, brush in the bushing may be too tight or become corroded or burned, and the magnetizing of the armature before spoken of will cause the lamp to flame and drop.

With the United States or Weston lamp the principal cause of trouble is the tripping from first to second set, and when this happens so that the second set burns first, it generally means a new set of contact springs and new magnets if the lamp burns entirely out of carbons; some of the causes for tripping are, rod sticks or wants new contact brush, lever hook loose, rod scrapes chimney on first set or too much hook on first set, adjusting screw on long hook set too high, lost motion in rocker shaft.

Causes of long arc are, platinum collar dirty or worn out, trip lever sticking or too loose, carbons not burning in proper proportion, burning holder before the carbon rod is down far enough to make contact with trip, small hook dirty, rod crooked near the top, weak magnet, fine wire burnt, clutch holder or armature sticks, rod a little thick at the top and brush too tight.

Causes for dropping out are, weak magnet either fine or coarse, lost motion in rocker, stiff clutch, too much clutch, not enough clutch, slight nigger in coarse wire, plunger too stiff or too loose, plunger bent, broken or crooked plunger rod, bad carbons, which may on starting become soldered together and cannot lift.

The globe holder or carbon holder of the arc lamp is a very much neglected part—that is, the insulations are not made heavy enough, but that the carbon dust or copper droppings falling over the insulations will give sufficient leak that a person standing on the ground and touching the bottom of the lamp may receive a very bad shock, this insulation should be made heavy and so placed that the carbon dust may not fall on it, as it is sometimes impossible to hang lamps under awnings high enough but that, when a person passes under them, they may be touched by any conductor which they may have in their hands. No part of the lamp outside of the globe should be allowed to have current in it. Arc lamps should be suspended by some perfect insulator, the regular porcelain insulator and hook being the best in our experience; this is a very important point and is often neglected, lamps being hung from an ordinary screw eye by a piece of wire are frequently seen, when it is as important that the lamp should be as well insulated as the balance of the circuit. Dirt must not be allowed to accumulate on any part of the lamp, rods, switches, bases and globes should be kept well cleaned, and all binding screws kept tight, the rods should be kept thoroughly well wiped every day with a clean cloth or waste, never allow crocus or emery to be used, as it badly wears the rods in the center, a better plan is if the rods become rough or dirty bring the lamp in and polish on the buffing-wheel, which will allow of its being kept of an even size its entire length. A properly tended lamp will need but little adjusting, but when it is required a regular appointed man should attend to it, or the lamp returned to the station for repairs.

The longest record for any one lamp in a constant street service is three years and nine months, without any adjustment other than the ordinary cleaning by the trimmer.

In order to get a good lamp record, no lamp should leave the test rack until it is perfect in all parts.

The most vexatious part of the arc lamp is the globe, it swells the item of expense in spite of the utmost care, besides being a great source of complaint, for I never knew one to be well enough cleaned, but there would be a complaint that it was not polished. The fused copper dropping and burning onto the glass makes them look dirty in spite of the best cleaning.

I have found, after a careful experiment, that it pays to put wire nets (which should be made of copper) on all globes, even for street lighting; having them covered with wire nets, prevents pieces from falling out even after they are badly cracked, and if the globe entirely gives way, the net will prevent its falling on some one's head.

Undue heat after the carbon has burned close to the holder, is one of the greatest causes for broken globes. This can be partially overcome by leaving the globe about one and one-half inches from the carbon holder.

In looking over the reports of former meetings of this Convention, it is easy to see that nearly all of the discussions have been on how to save coal; of course, this is a point where large money may be saved by use of proper boilers and settings, but the best of these will do no good without proper firing.

There are many other points in the management of an electric light station which are just as important, the most serious of these is the pay roll, as two men more than is necessary will cost nearly as much as a ton of coal per day, and 30 tons of coal per month would be quite a saving, and yet while keeping the number of men as low as possible, none but first-class men should be employed, that all work may be done in a first-class substantial manner. Especially must trimmers attend to their duty well, as the quality of their work dictates the amount of rebates to be allowed during the month. Another important man in this respect is the dynamo-man. He should give the dynamos the most assiduous attention, that the strength of the current may be kept constant, while flashings and interruptions of the current may be reduced to a minimum, for no matter how well every other department of a station is carried on, if the current is allowed to vary from the standard, complaints will follow, and they are expensive.

There is nothing that angers a user of electric lights so much as to have them flash; it may be only one or two seconds that they are out, but it always seems like a much longer time, especially if in a crowded hall. Rather have the record for continuity of lights so good that even the gas fixtures may be removed; this can only be gained by close attention to the machines, wires and lamps.

I call to mind one place that we have lighted continuously, without any other method of illumination than arc lamps, for over eight years, and during that time the lights have never been out during lighting hours.

The waste in the use of carbons is a very important feature. These should be dealt out and every stump returned; the amount saved in laying by the four and five inch stumps to be used in the summer months will make a saving of at least 10,000 carbons per year for a 1,000 light station.

At the time I first started dealing out carbons and bringing in stumps, I saved on an average over $30 per month, and then only trimming about 400 lamps per day.

A very important feature of arc light stations is the inside wiring and line construction which is very much neglected; all inside wiring should be of best quality of insulation, and run on glass or porcelain throughout their whole length.

An arc light wire should never be concealed.

The use of soft rubber tubing for passing through floors, ceilings, walls, etc., should never be allowed, the only suitable material for such work is hard rubber tubing.

While I am a great believer in the use of the best quality of insulation for line construction, yet it is not best to depend entirely on such insulation for safety.

Put up the best wire there is, and then apply a rigid system of inspection and tests, not by that abomination of tests, the magneto bell. Not only should the tests be made on dead lines, but should be made at least once in two hours on all live wires, and when grounds or bad leaks are discovered, they should be immediately cleared, by that means preventing the second ground, which is the element of danger.

I have repeatedly had lines that would test clear at the time of putting on circuits, but two hours after, solid grounds have been discovered, located, and found to be wires broken down, hanging over the electric light wires and reaching down to the sidewalk, where they are a source of danger to every passer by; besides every boy that passes must feel of it to see if there is any electricity in it.

My orders are to drop all work that is not absolutely necessary to clear grounds.

In Philadelphia we receive great help from the electrical bureau of the city, by their promptly reporting all wires that are down on us.

All lines should be cut by one man, who is especially instructed and detailed for that work, as then you are enabled to pick out a thoroughly reliable man and drill him in the work that he is to do, then, by never allowing a circuit to be opened, and teaching all men to never depend on any insulation but to treat all wires and lamps as if they were charged with an electric light current, dangers to employés will be reduced to a minimum.

GENERAL NEWS.

The New Jersey Telephone Company recently decided to continue its wires from Plainfield to Bound Brook, Finderene and other adjacent towns, whose residents have been clamoring for telephone service for years. The work of extending the line was progressing rapidly when a farmer who owns a wide tract of land through which the company wants a right of way, refused to allow a post-hole to be dug on his land, unless the company paid him a bonus of $500. The matter will be carried into the courts.

Judge Taft, of the Superior Court, of Cincinnati, has decided the case of the Telephone Company against the Mount Auburn Electric Street R. R. Company. The telephone company asked for an injunction restraining the defendants from using the single trolley system, on the ground that such use interfered with the operation of telephone wires. The court decided in favor of the telephone company, granting the injunction, but allowing the street railway company six months in which to make necessary changes.

In the London *Electrical Engineer* we note that the laying of the Ferranti mains from Deptford to London is about to be begun, and that the work will take about nine weeks to accomplish. We would direct the attention of a New York contemporary, which announces itself as "the electrical paper of the future," to this piece of information. A short time ago our contemporary published a statement that the Ferranti mains had been working for about a year, carrying a current of 10,000 volts pressure. If our contemporary is not more careful as to the accuracy of its information, it runs risk of becoming an "electrical paper of the past."

The Post Office Committee of the House of Representatives gave a hearing, last week, to Postmaster General Wanamaker, who presented his scheme for a government telegraph system. President Norvin Green, of the W. U. Telegraph Company, will shortly appear before the committee to present an argument against it, and Mr. Gardiner G. Hubbard is expected to follow with a statement of his views on the subject. Mr. Hubbard's plan is to have a private company construct an independent system of lines to be operated entirely by the government or under its immediate control. With such a company to provide and maintain the necessary lines for a fair return on the investment, and the government to carry on the business without profit (provided the work is done by experienced and competent operators), there would seem to be promise of a successful government telegraph.

C. R. Vincent & Company, of 15 Cortlandt St., this city, filled the contract for 12 of the Ball engines mentioned in the article about the Brooklyn Edison station, by Mr. C. J. Field, in next issue of the ELECTRICAL REVIEW. Messrs. Vincent & Company are the general Eastern agents for the well-known Ball automatic high-speed engines.

The Westinghouse Machine Company, of Pittsburgh, has received an order through its agency at Copenhagen, Denmark, for one of its automatic compound engines. The size selected is 14 and 24x14 and it will be used at Kopparbergs Bergslaget at Falur, near Stockholm, Sweden. Large numbers of these engines are now being shipped to foreign countries.

New Catalogue.—The motor department of the Thomson-Houston Electric Company has issued a very tasty catalogue containing a number of half-tone plates showing the practical applications of the Thomson-Houston motor. The cuts are made by direct process from photographs taken on the spot, so that one may judge accurately as to the many advantages of electricity over steam, where small units of power are to be distributed over large areas.

The Westinghouse Electric Company's Works, Pittsburgh, Pa., are rapidly hurrying the dynamos for the Boston arc light plant toward completion. The contract calls for 650 lights, for which electricity is to be generated by 11 dynamos, 60 lights each, of the new Westinghouse arc light system; four machines had been shipped already and the others will follow within a few weeks. The Westinghouse Electric Company is also furnishing a new arc light outfit to the United Electric Light and Power Company, of New York City. Ten 125-light arc machines of the new alternating current system have been ordered, one of which has been shipped. The remainder will follow as soon as possible.

The Metropolitan Electric Light Company operates a number of large central stations in the city of London. One was recently equipped with an outfit of

4—14 and 24x14, Westinghouse compound engines.
2—10 and 18x10, " " "
1—12 and 20x12, " " "

Another station operated in the same city by the same company is equipped with single-acting engines of English make. Quite a good-natured rivalry exists, of course, between the men who are in charge of these stations. Recently, the American engines were put through their paces by British experts, on behalf of the Metropolitan Company, in a test lasting 12 hours without intermission. It was amusing to see the interest taken in this test by the American colony in London, many members of which spent the greater part of the day in the station. Even our respected minister plenipotentiary and envoy extraordinary, Mr. Lincoln, was on hand to see the American eagle properly comforted and encouraged in its hour of trial. Being called away on important business, he returned at a later hour, in order to make sure that American interests and American dignity were being properly upheld. The engines in question are running regularly under a very heavy service, and the experts subjected them to many severe tests during the day; but they behaved so splendidly in all respects that the Englishmen were agreeably surprised. Some of the Americans who took such a lively interest in this test really know very little about steam engineering, but they were wildly enthusiastic at the way in which these engines upheld America's reputation for good machinery in London. Already orders have been sent to The Westinghouse Machine Company at Pittsburgh for

1—18 and 30x16, Westinghouse compound engine,
1—14 and 24x14, " " "
1—10 and 18x10, " " "
1— 9 and 15x 9, " " "

for the same London station, so that it is fair to assume that this type of engine is giving satisfaction in the "tight little isle."

Search Light for Use in Fog or Mist.

The steamer "Rhode Island" has just been equipped with a Huntington search light for the purpose of locating a vessel's position in the Sound when fog, mist or snow prevails. The "Massachusetts," of the same line, is to be equipped with a similar light. Experiments are also being made with it on the Providence steamers. The experiments with the light show that the Sound fogs are generally low, and can be penetrated by a powerful electric light, especially when projected vertically. Pilots report having seen the projected beam of light 18 miles. The column of light resembles a stream of water thrown from a hose. Heretofore vessels have been fitted with search lights to throw beams horizontally so as to distinguish approaching danger. Pilots say such lights are useless in thick weather, as no light can penetrate a thick fox horizontally. They are worse than useless and blind the men in the pilot house. On the other hand a light projected vertically, in that direction in which the fog is least thick, will throw a loom fixing the position of the vessel. The instrument is made of brass and copper, placed on top of the pilot house, and worked from within, where it can be depressed to any angle. The candle-power is 3,000.

The Bill to Regulate the Rates for Messages.

Senator Cullom reported favorably last week, from the Committee on Commerce Senator Spooner's bill to regulate interstate commerce carried on by telegraph.

The bill provides that it shall be unlawful to make unreasonable charges for the service; to give any unreasonable preference or advantage to any person or firm; to enter into any pool for the division of receipts; to give any rebate or reduction in price to any person, firm or corporation, not given to others. It is further provided that every telegraph company shall publish its rules from time to time as prescribed by the commission, and shall file with said commission a sworn schedule of rates.

Failure to perform any of the requirements of the act makes the company liable to the person injured thereby for the full amount of damages sustained, together with costs and attorney's fee. Persons claiming to be damaged may make complaint to the commission or may sue in the United States Court. Any officer of a telegraph company violating the provisions of the act, or who willingly suffers or permits any violation, shall be deemed guilty of a misdemeanor, and upon conviction in a district court of the United States, be subject to a fine not exceeding $5,000 for each offense.

The Interstate Commerce Commission, created by the act of Feb. 4, 1887, is given jurisdiction over telegraph companies and the business transacted by them, and is authorized to enforce the provisions of the act.

Lincoln, Neb.—Articles of incorporation of the Lincoln Electric Railway Company were filed in the office of the register of deeds, last week. The territory for invasion covers the entire city, including West Lincoln and the university sites. The capital stock of the company is placed at $100,000, divided into 2,000 shares of $50 each. The first board will consist of the following gentlemen: Henry T. Clark, Thomas Ryan, A. M. Gardner, A. M. Trimble, George Downing, A. C. Ziemer and A. C. Ricketts. The incorporators are: E. H. Andrus, A. C. Ricketts, John K. Barr, A. C. Ziemer, Thomas Ryan and John S. Reed.

Dover, N. H.—The Consolidated Electric Light and Power Company, chartered in the Maine Legislature last winter and the New Hampshire Legislature last summer, has consolidated the electric light plants of the Dover Electric Company, the Great Falls Electric Light Company and the Rochester Electric Lighting Company, with headquarters in this city. The power plant is at the new dam below Great Falls on the Maine side of the river. Dover, Sawyers, South Berwick, Salmon Falls, North Berwick, Rochester, Great Falls, Berwick, Gonic and East Rochester, will be lighted by this system.

NEW YORK SUPREME COURT, City and County of New York.—Washington A. Roebling, as trustee, plaintiff, against Vitrite and Luminoid Company and William P. Chambers, as receiver, defendants.

In pursuance of a decree of foreclosure and sale, granted by this Court, and entered in the above entitled action on the 30th day of July, 1889, and in pursuance of further orders made by the said Court on the foot of said decree or judgment, and entered herein respectively on the 8th day of January, 1890, and the 21st day of January, 1890, I, the undersigned, referee, duly appointed in this action for such purpose, will sell at public auction, at the Real Estate Exchange and Auction Rooms, Limited, Nos. 59 to 61 Liberty street, in the City of New York, on the 21st day of February, 1890, at 12 o'clock noon of that day, by Richard V. Harnett, auctioneer, all and singular the patents and letters patent, franchises, liberties, rights, etc., mentioned in said decree and in the order entered herein on the 8th day of January, 1890, and described as follows, to wit:

Ten certain letters patent of the United States, issued to Alfred Swan, of Gateshead-on-Tyne, England, numbered respectively 263,621, 263,622, 263,623, 264,970, 275,730, 276,924, 276,982, 282,472, 292,447, 343,965, covering all the certain improvements and inventions therein claimed, and also the secret process for the manufacture of the material known as vitrite; also four certain letters patent of the United States granted to Nelson S. White, and numbered respectively 289,590, 301,192, 314,208, 324,530; one patent granted to Andrew B. Searles, numbered 271,059, and an English patent granted to Henry Harris Lake, numbered 9,649; also a Belgian patent granted to Nelson S. White, numbered 65,647; and an Italian patent, granted to said White on December 3d, 1884; also two trade-marks of the United States granted to Clinton M. Ball, numbered 12,538 and 12,539, and also including franchises, privileges, rights and liabilities of said Vitrite and Luminoid Company, covered by said mortgage, and also the following letters patent and inventions, to wit:

Certain letters patent of the United States, issued to Alfred Swan, of Newcastle-on-Tyne, England, numbered 362,469, dated May 3d, 1887, for improvements in electric switches; also letters patent of the United States, issued to Alfred Swan, numbered 339,822, dated April 13th, 1886, and covering all inventions and improvements therein claimed; also letters patent of the United States, issued to Clinton M. Ball, of Troy, New York, numbered 346,345, dated July 27th, 1886, and covering all inventions and improvements therein claimed; and also the right, title and interest which the Vitrite and Luminoid Company had or has in and to the following described patents:

Serial.
America, 210,551; filed August 10th, 1886.
America, 212,615; filed September 3d, 1886.
America, 239,240; filed May 24th, 1887.
America, 204,752; filed June 10th, 1886.
Austria, 34,644; } dated January 17th, 1886.
Austria, 67,969; }
America, 246,799; filed August 11th, 1887.
Italy, 17,130; application July 1st, 1884, and issued December 3d, 1885.
Belgium, 65,647; dated July 15th, 1884.

Dated January 29th, 1890.

CHARLES DEKAY TOWNSEND, *Referee.*

CHAS. H. JOHNSON, *Plaintiff's Attorney,* 5 Beekman street, N. Y. City.

N. B.—The foregoing mentioned letters patent or description of same will be found at the office of Washington A. Roebling, 117 Liberty street, New York City, where the same may be inspected.

The foregoing sale is hereby adjourned to February 25th, 1890, at same hour and place.

Dated New York, February 21st, 1890.

CHARLES DEKAY TOWNSEND, *Referee.*

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Correspondence addressed to "ELECTRIC," care of Editor ELECTRICAL REVIEW, will receive prompt attention.

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON FEBRUARY 11, 1889.

420,935 Electric body battery; Oliver S. Hall, Marion, Iowa, assignor of one-half to James M. Gray, same place.

420,954 420,955 Electro-mechanical movement; Samuel E. Nutting, Chicago, Ill., assignor to the Nutting Electric Manufacturing Company, same place.

420,964 Electric vote indicator and recorder for legislative bodies; William H. Robinson, Rochester, N. Y.

420,975 Storage battery; Chas. Lorley, New York, N. Y., assignor to the Anglo-American Electric Light Manufacturing Company, of West Virginia.

420,984 Lightning arrester; Geo. G. Bayne, Fremont, Neb.

421,006 Telephone transmitter and receiver; Hosea W. Libbey, Boston, Mass.

421,011 Attachment for telephones; Geo. F. Newland, Detroit, Mich.

421,014 Automatic fan; William R. Polk, Jr., Atlanta, Ga.

421,048 Regulator for dynamos; Edward Heymann and Frank W. Heymann, Boston, assignors to James E. Maynadier, Taunton, Mass.

421,053 Thermo-electric resistance regulator; Samuel E. Nutting, Chicago, Ill., assignor to the Nutting Electric Manufacturing Company, same place.

421,067 Art of making cores for electro-magnets; Stanley C. C. Currie, Philadelphia, Pa., assignor to the United Electric Improvement Company, Gloucester City, N. J.

421,081 Galvanic battery; Jacob F. Mehren, Chicago, Ill.

421,088 Conduit for electric cables; William P. Tyler, Boston, Mass.

421,090 Starting switch for electric motors; William A. Anthony, Manchester, Conn., assignor to the Mather Electric Company, same place.

421,114 Switchboard; William M. Stewart, Schenectady, N. Y.

421,169 Electric battery; Ernest M. G. Hewett, Newton, Mass., assignor by direct and mesne assignments to the Safety Electric Light Company, of Maine.

421,177 Safety device for electric circuits; Hermann Lemp, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut.

421,179 Cut-out. 421,180 Thermal cut-out; Everett W. Little, New York, N. Y.

421,185 Electric soldering iron; Willard M. Miner, Plainfield, N. J.

421,193 Transmission of power by electricity; Edwin W. Rice, Jr., Lynn, Mass.

421,195 Motor for electric regulating apparatus; Friedrich Ross and Asmus Franzen, Vienna, Austria-Hungary.

421,207 Cut-out for incandescent lamps. 421,208 System of distribution for alternating currents; Elihu Thomson, Lynn, Mass.

421,214 Telegraphic sounder; Geo. W. White, Huntsville, Ala.

421,222 Commutator for dynamos, motor, etc.; Geo. H. Alton and William O. Wakefield, Lynn, Mass., assignors to the Thomson-Houston Company, of Connecticut.

421,239 Railway electric signal; Paul D. Cable, St. Louis, Mo.

421,240 Thermal cut-out; Philip Cardew, Chatham, County of Kent, assignor to Bernard Mervyn Drake and John Marshall Gorham, Westminster, England.

421,294 Electrical spray and vapor baths; Nathaniel Lyke, Williamsport, Pa.

421,304 Trolley for electric railways. 421,305 Overhead trolleys for electric railways; Frank B. Rae, Detroit, Mich., assignor to the Detroit Electrical Works, same place.

421,320 Collecting contact for electric machines; Albert Schmid and Edward C. Means, Allegheny, Pa.; said Schmid assignor to the Westinghouse Electric Company, Pittsburgh, Pa.

421,334 Spring motor; James T. Wallace and William D. Holleman, Gould, Texas.

421,340 Electric compound push; John F. Wollensak, Chicago, Ill.

421,371 Electrical communication; James L. Cutler, Piketon, assignor to Joseph A. Sullivan, Frank O. Loveland and Guy Mallon, all of Cincinnati, Ohio.

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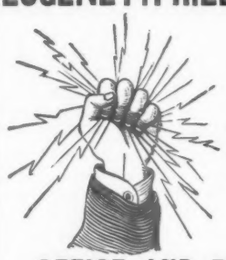

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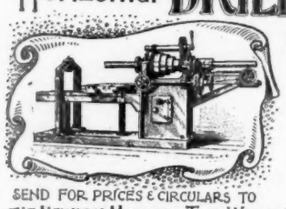

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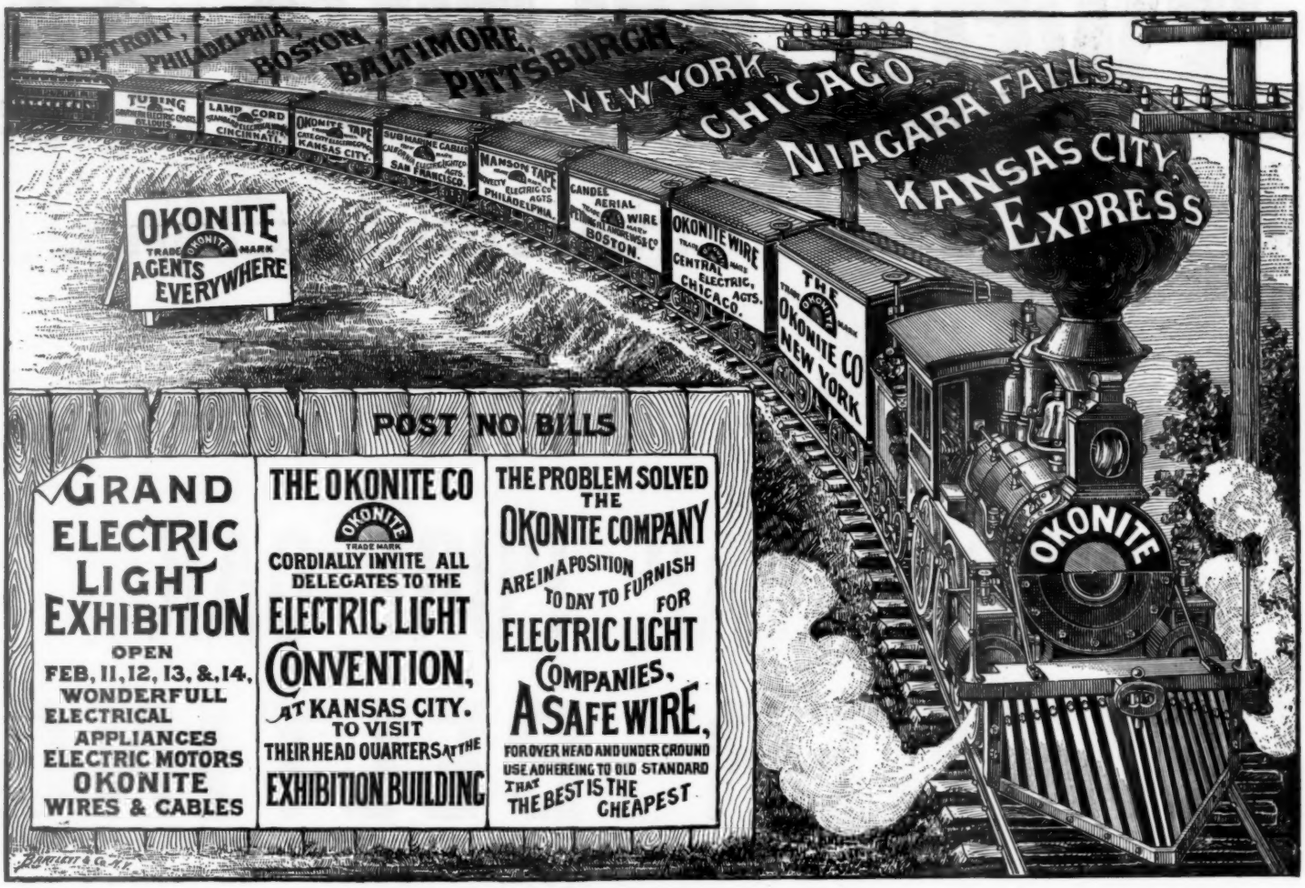
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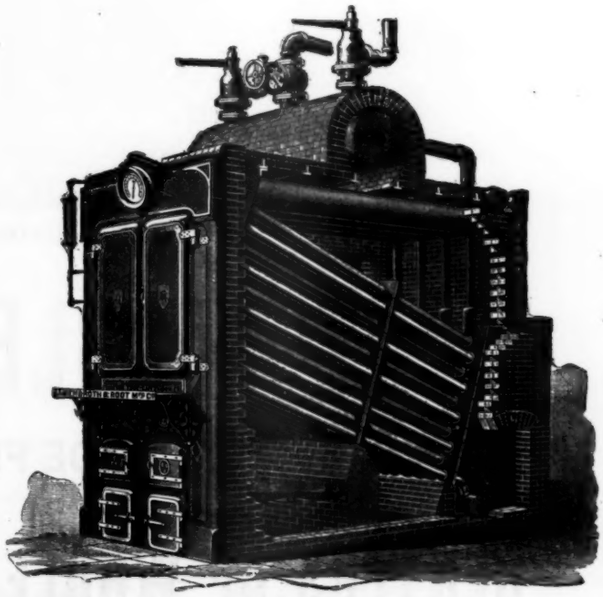

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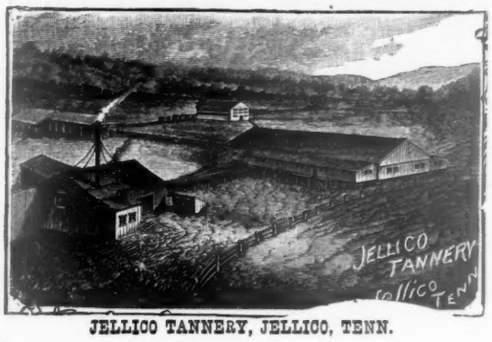

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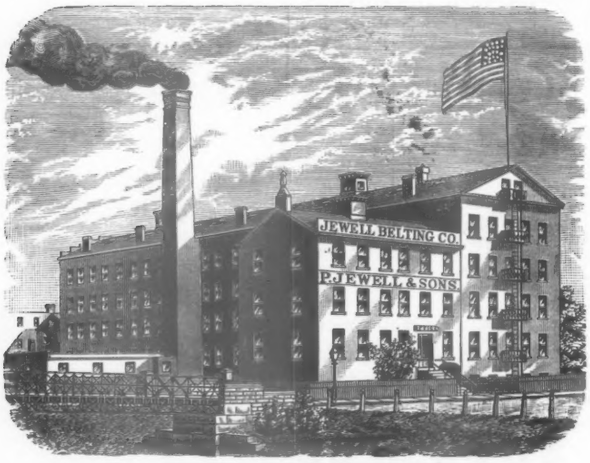

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LIGHT DOUBLE DYNAMO BELTS

ARE ALWAYS MADE FROM

CENTERS OF WHOLE HIDES

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AUTOMATIC ELECTRIC MOTOR

IS

Made in all Sizes from ½ H. P. Upwards.

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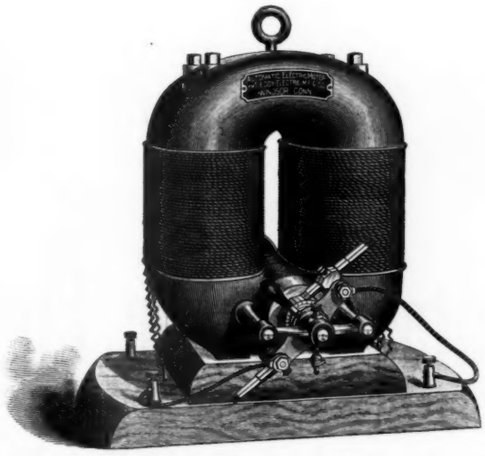
IT IS WOUND FOR CONSTANT POTENTIAL CIRCUITS ONLY.



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With Reversing Motor connected to Hoisting Machine direct.

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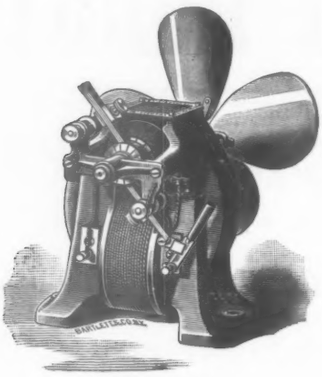
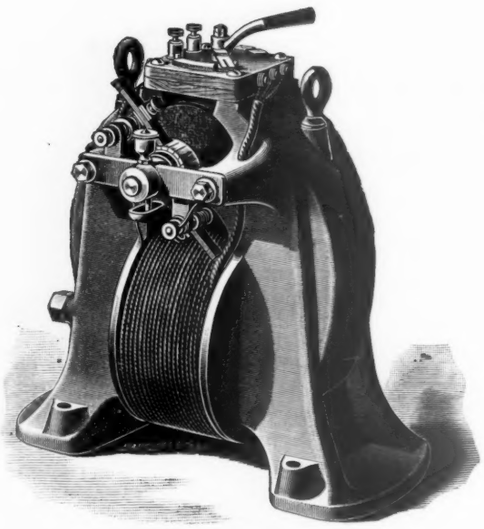
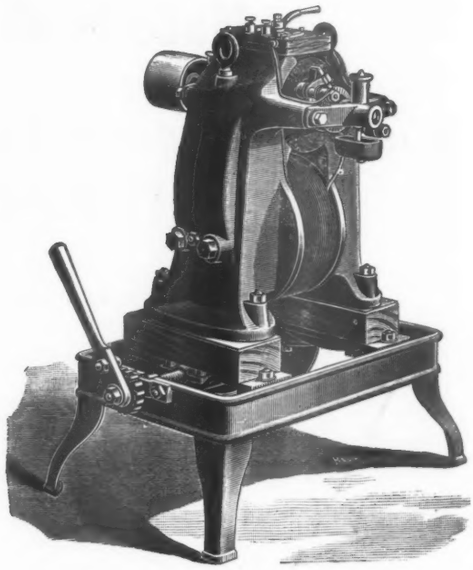


FAN MOTOR.



MOTOR WITHOUT BASE.



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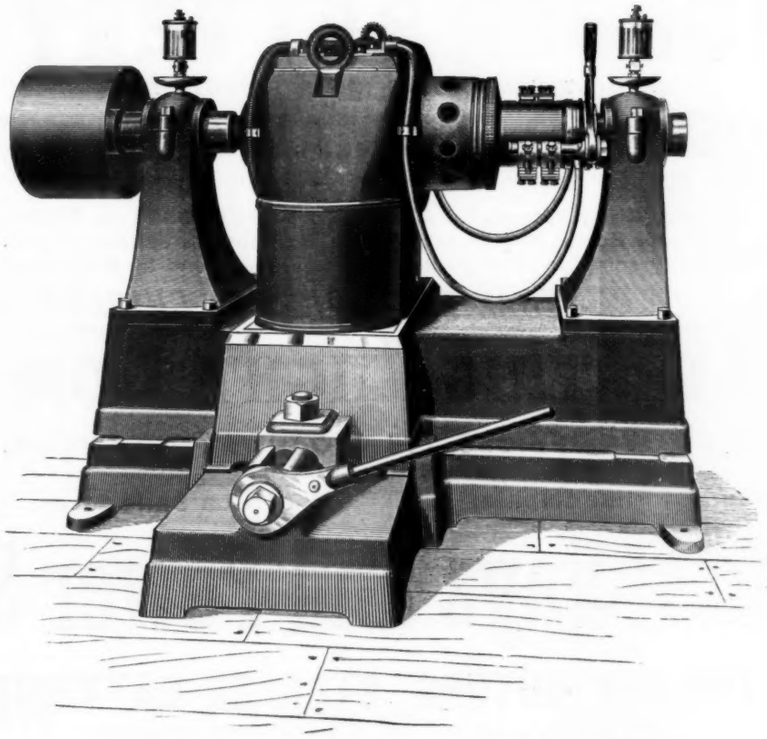

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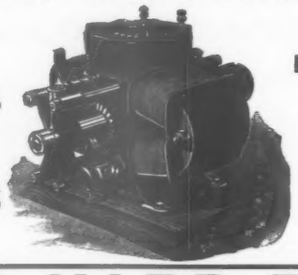

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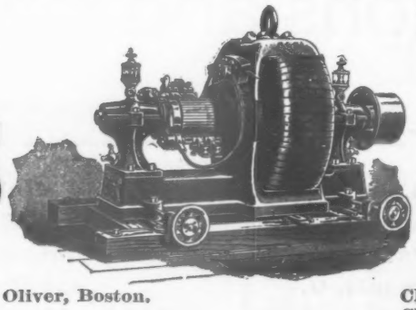

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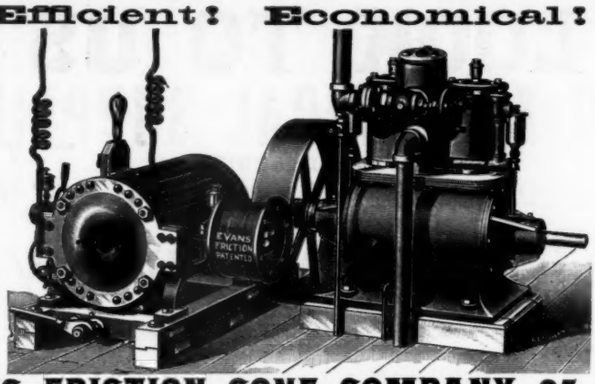

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Designation of Machine.	No. Lights 2,000 c. p. 10 amp. X	No. Lights 1,600 c. p. 8 amp. Y	No. Lights 1,200 c. p. 6 amp. Z	No. Lights 800 c. p. 4 amp.	Horse-Power at Pulley of Dynamo.	Width of Single Belt in Inches.	Belt Speed Required.	Weight of Dynamo.
C	8	.....	.....	.....	6.5	1¼	5,000 FEET PER MINUTE.	530
C	.....	10	.....	.....	6.3	1¼		530
C	.....	.....	.....	25	8.0	2		530
C	16	.....	.....	.....	12.0	2¾		780
C	.....	20	.....	.....	12.5	2¾		780
C	.....	.....	35	.....	13.0	2¾		780
C	20	.....	.....	.....	15.0	3		990
C	.....	25	.....	.....	15.6	3		990
C	.....	.....	32	.....	15.0	3		990
C	.....	.....	.....	50	16.0	3		990
C	28	.....	.....	.....	21.0	4½		1,360

Ball Electric Light Co.
18 CORTLANDT ST. NEW YORK

LIST OF DYNAMOS IN STOCK.

Designation of Machine.	No. Lights 2,000 c. p. 10 amp. X	No. Lights 1,600 c. p. 8 amp. Y	No. Lights 1,200 c. p. 6 amp. Z	No. Lights 800 c. p. 4 amp.	Horse-Power at Pulley of Dynamo.	Width of Single Belt in inches.	Belt Speed Required.	Weight of Dynamo.
G	.....	35	.....	.....	21.0	4	5,000 FEET PER MINUTE.	1,360
H	.....	.....	45	70	21.0	4		1,360
I	.....	.....	.....	.....	21.0	4½		1,360
J	40	.....	.....	.....	29.7	6		1,750
K	.....	50	.....	.....	30.0	6		1,750
L	.....	.....	64	.....	29.5	6		1,750
M	52	.....	.....	.....	38.0	8		2,290
N	.....	65	.....	.....	38.6	8		2,290
O	.....	.....	88	.....	38.0	8		2,290
P	64	.....	.....	.....	46.5	10		2,770
Q	.....	80	.....	.....	47.1	10		2,770
R	75	.....	.....	.....	52.5	12		3,200

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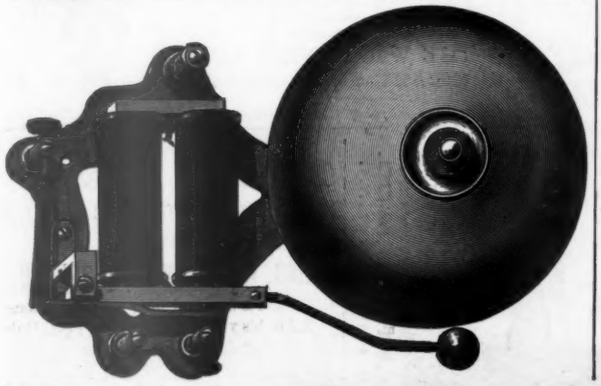

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Sight chamber is fitted with square window panes, which are secured by brass end plates, and can be removed for inspection, cleaning or repairs, at any time, while the machine is running.
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FIG. 2.
Shows flow of oil stopped when machinery stops.
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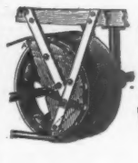
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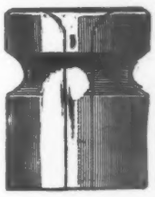

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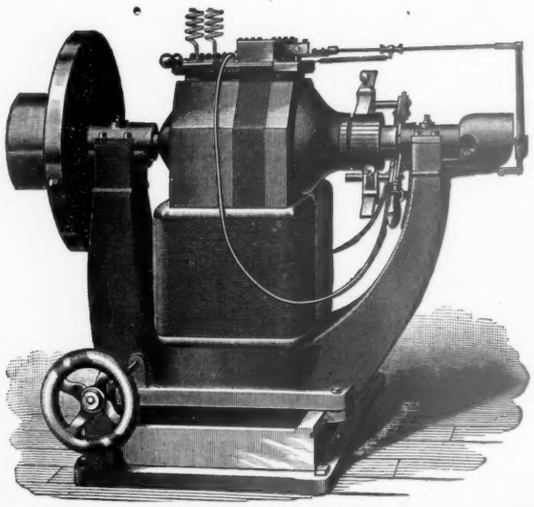

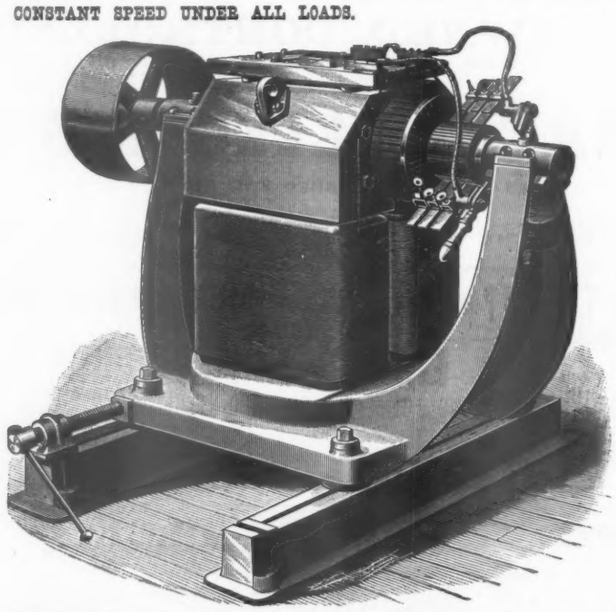

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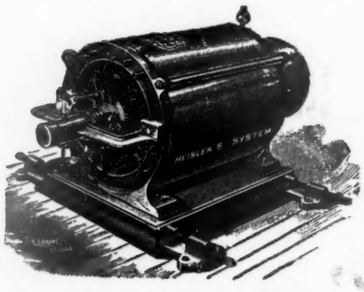

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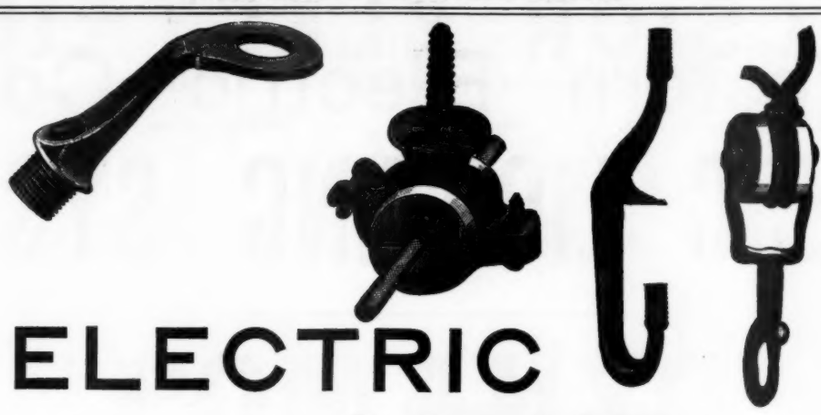

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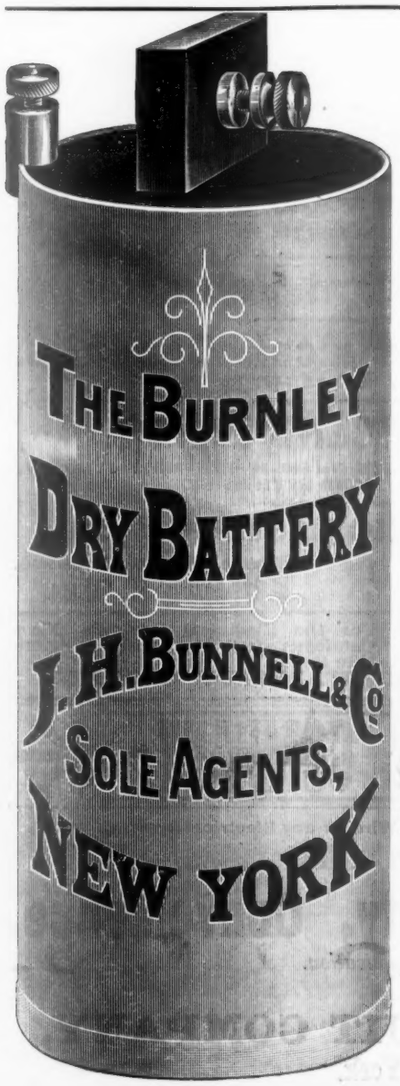

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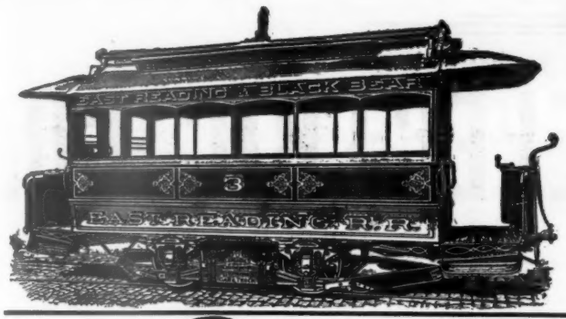

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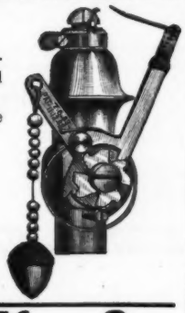

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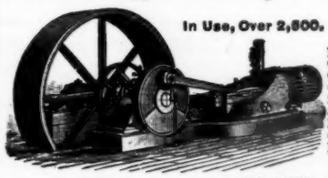

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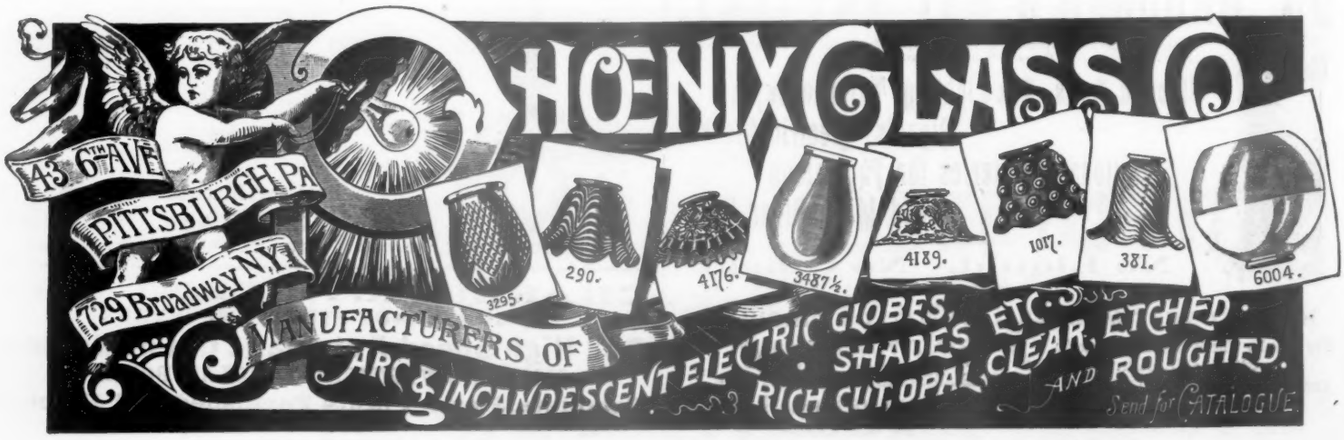

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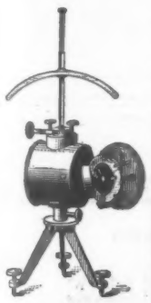
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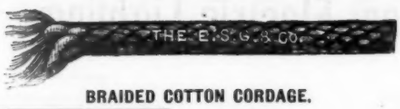

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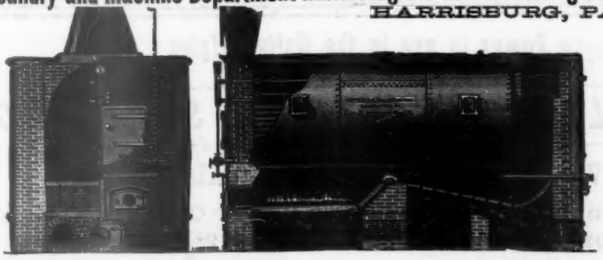

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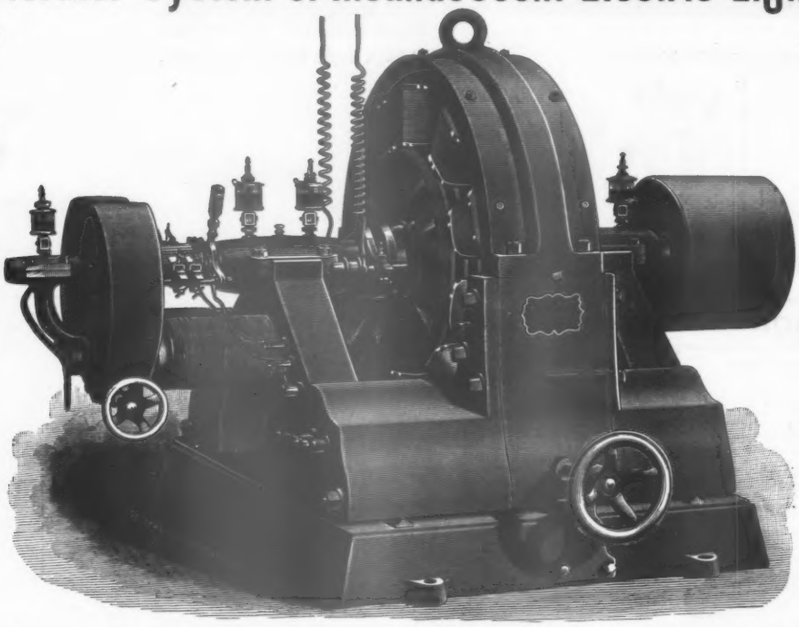

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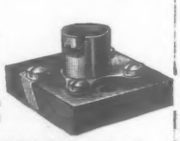

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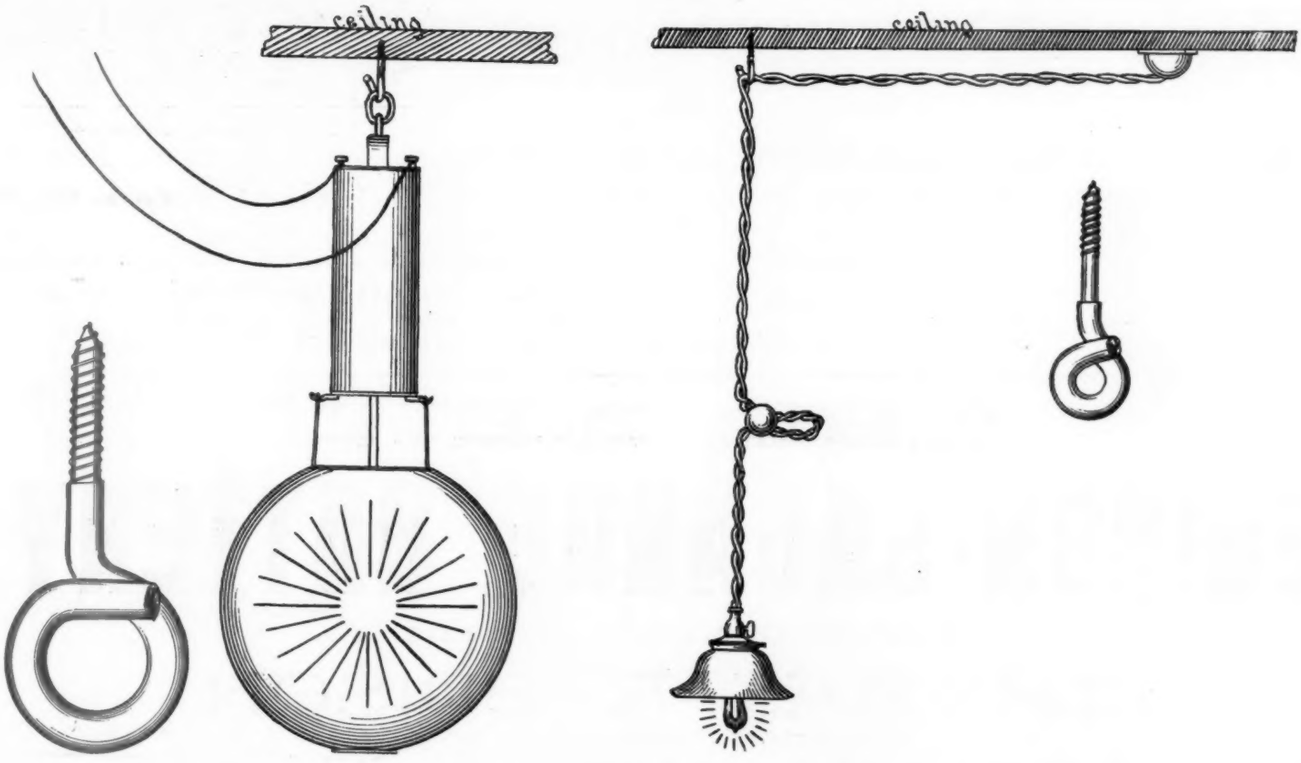

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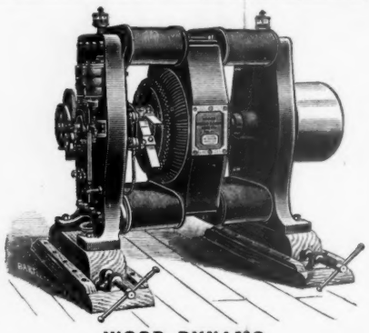

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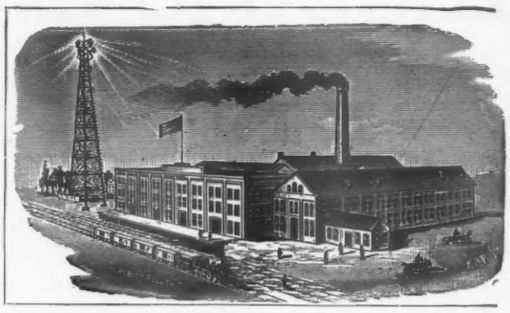

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